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Systematic review

Defining health information exchange: scoping review of published definitions

Ather Akhlaq

Department of Health and Hospital Management, Institute of Business Management,
Korangi Creek, Karachi, Pakistan
Centre for Medical Informatics, Usher Institute of Population Health Sciences and Informatics,
Medical School, University of Edinburgh, United Kingdom

Aziz Sheikh

Centre for Medical Informatics, Usher Institute of Population Health Sciences and Informatics,
Medical School, University of Edinburgh, United Kingdom

Claudia Pagliari

Usher Institute of Population Health Sciences and Informatics, Medical School, University of Edinburgh,
United Kingdom

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Author address for correspondence

Dr. Ather Akhlaq
Assistant Professor of eHealth, Health and Hospital
Management, Institute of Business Management,
Korangi Creek, Karachi, Pakistan
Email: ather.akhlaq@iobm.edu.pk

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ABSTRACT

Objective The term health information exchange (HIE) is often used in health informatics, yet uncertainties remain about its precise meaning. This scoping review aimed to capture and analyse existing definitions in order to map variations in the use of this term and the concepts associated with it.

Methods Systematic literature search to identify published definitions of HIE and related terms. Medline, Web of Science, Library Information Science and Technology Abstracts, EMBASE and CINAHL Plus were searched to identify relevant papers, and Google to identify grey literature. Searches were not limited by language or date of publication. Both explicit and equivalent conceptual definitions were included. Included definitions were summarised and thematically analysed in order to identify and map the underpinning constructs.

Results Our searches revealed 603 scientific articles and 5981 website links. From these, a total of 268 unique definitions of HIE were identified and extracted: 103 from scientific databases and 165 from Google. Eleven constructs emerged from the thematic analysis. Contextual factors influenced the emphasis of the definitions and the overall framing of HIE as an organisational entity that facilitates and or as a process of sharing health information between diverse stakeholders.

Conclusions HIE is a complex and evolving construct, for which multiple definitions exist. In order to encourage consensus, the authors propose this broad definition, which encompasses the key attributes of HIE described in the literature: “HIE is the electronic mobilisation of clinical and administrative information within or across organisations in a region or community and, potentially, internationally between various systems according to locally and/or nationally recognised standards while maintaining the authenticity and accuracy of the information being exchanged, enabling stakeholders to make informed decisions to enhance healthcare quality of a patient and population. HIEs are multi-stakeholder organisations that oversee the business, operational and legal issues involved in the exchange of information.”

Keywords: eHealth, health informatics, health information exchange, scoping review

INTRODUCTION

Effectively delivering integrated patient care and business transactions within the healthcare ecosystem requires the exchange of patient-related data between stakeholders within and across organisations, in order to support clinical decision making and organisational functions such as insurer reimbursement.¹ The process of transferring or sharing this information using information and communications technologies is often referred to as electronic health information exchange (HIE).^{2,3}

Much of the current narrative around HIE has been centred around the United States (US) policy context, arising from the Health Information Technology for Economic and Clinical Health (HITECH) Act. This aims to improve the efficiency, consistency, safety and equity of healthcare services through better information sharing between relevant stakeholders, contingent upon the 'meaningful use' of electronic health records (EHRs), and is backed by a programme of financial incentives and penalties to encourage change.^{4,5} These developments have drawn particular attention to HIE in the US, although the same activities are being undertaken internationally. The screenshot in Figure 1 shows the number of global Google searches, since 2004, for the specific term 'HIE' (lower line) and the topic more generally, which is computed from several indicators (upper line).

Much of the web traffic shown in Figure 1 is driven from the US and closely reflects the 'meaningful use' agenda, which has important but somewhat different implications for clinicians, healthcare delivery organisations, insurers and healthcare information technology providers. It also reflects the explicit use of the search term 'HIE', which is close-coupled with the US policy and business environment.

Although the term HIE is widely used, the way in which it is used varies in significant ways across stakeholders and contexts, including policymakers, academic institutions,

professional organisations and funding bodies. Examples of diversity include 'occupational' HIE,⁴ HIE as a feature of the EHR⁵ and HIE as a corporate network of data warehouses serving a health organisation.⁶ This raises the potential for ambiguous or inconsistent definitions to hinder meaningful dialogue around health informatics policy, research and practice. For this reason, we decided to undertake a detailed scoping review in order to analyse the ways in which the term is being interpreted in the literature and how these vary across different organisations and contexts. The research therefore set out to answer the question "What is HIE?" with reference to the ways in which it has been defined and the concepts underpinning these definitions. The approach was inspired by earlier scoping reviews of eHealth^{7,8} and aimed to clarify the different uses of the term in order to aid the sharing of information about HIE across stakeholders and inform emerging taxonomies in health informatics.^{9,10}

METHODS

Design

Systematic scoping review of the published and grey literature.¹¹

Inclusion criteria

Definitions appearing in print or digital format were searched that explicitly refer to HIE or equivalent terms such as *clinical information exchange* and *healthcare information exchange*, as well as related concepts such as electronic data interchange (EDI). 'Definition' was taken to include *explicit* statements of the meaning of the term with reference to key concepts (e.g. 'HIE is the movement of patient information across nodes of a health system using health information technologies and standards for data exchange') and *conceptual* definitions, in the form of functional descriptions of HIE (e.g. 'organisations exchange health information

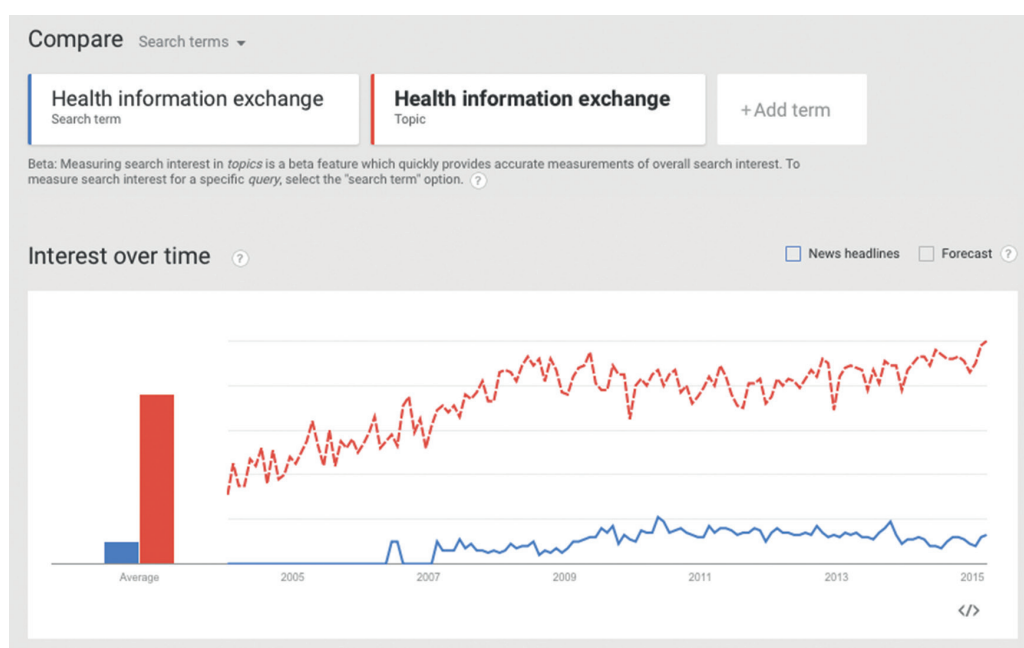


Figure 1 Google searches for HIE as a search string and a topic, since 2005.
Source: Google Trends. Computed on 22 March 2015

using middleware systems and interoperability standards such as HL7').

Exclusion criteria

References to HIE not accompanied by either an explicit or an implied definition (as above) were excluded.

Search strategy

Searches were not limited by language. The searches covered the period from 1900 to February 2014.

Web searches: AA and CP first conducted a Google search using the narrative terms shown in Table 1.

Scientific databases

The explicit search terms and structured queries shown in Table 2 were used to interrogate Medline; Web of Science; Library Information Science and Technology Abstracts; EMBASE; and CINAHL Plus. There was no medical subject heading (MeSH) term available for HIE, clinical information exchange or healthcare information exchange and hence the reliance on key words.

Query strings were adapted as necessary for each academic database and for the purposes of Google searching. Titles, abstracts and text of the citations identified in the academic database were independently reviewed by two authors (AA and CP) before articles were retrieved for further analysis. Any disagreements between the investigators were resolved by a third reviewer (AS).

Reference lists of the included articles were also scrutinised for any relevant sources and cited work. Websites included reports, encyclopaedias, dictionaries, blogs, hospitals, vendors, letters, presentations, documents, white papers, articles and references. Duplicate citations and definitions were excluded from the results.

Table 1 Summary of Google searches

Search string	Hits	Total results viewed	Unique definitions included
What is health information exchange definition	33,000,000	1000 (100 pages)	61
HIE definition	32,200,000	1000 (100 pages)	13
What is HIE?	38,900,000	997 (100 pages)	35
What is HIE (health information exchange)	2,160,000	991 (100 pages)	42
Clinical information exchange	20,300,000	993 (100 pages)	10
Health care information exchange	111,000,000	1000 (100 pages)	13

Data extraction

Data extraction tables were prepared to include details of the definition, *author*, source, year and country of origin. Duplicates appearing in more than one database were excluded prior to further analysis.

Analysis

As this was a scoping review of definitions, rather than a systematic review of research evidence, analysis did not involve appraisal of study quality.^{8,12–14}

All potentially relevant articles identified by the search were analysed by hand in order to determine whether they contained an explicit definition of the term or an equivalent conceptual definition. Definitions were descriptively

Table 2 Summary of academic database searches

Database	Search string	Keyword/topic	Hits	Results after duplication removed	Unique definitions included
Medline	'Health information exchange' or 'clinical information exchange' or 'health care information exchange'	Keyword	400	23	14
Web of science	'Health information exchange' or 'clinical information exchange' or 'health care information exchange'	Topic	408	50	30
Library information science and technology abstracts	'Health information exchange' or 'clinical information exchange' or 'health care information exchange'	Keyword	81	70	2
EMBASE	'Health information exchange' or 'clinical information exchange' or 'health care information exchange'	Keyword	460	293	69
CINAHL plus	'Health information exchange' or 'clinical information exchange' or 'health care information exchange'	Keyword	230	167	9

analysed according to publication date, geographical origin, provenance, and terminology used. AA undertook a high-level pass through the data to create a draft coding framework, which was refined in consultation with CP before beginning the coding process.^{8,12} Definitions were then thematically analysed, with each definition coded according to its various qualitative attributes. The codes were iteratively adapted in order to achieve the best fit with the data, equivalent to qualitative research, where coding proceeds until the point of 'saturation' where no new codes were required to describe the data.

RESULTS

The Google search yielded 5981 Web pages referring to the term HIE, whilst the searches of scientific databases revealed 603 articles referring to HIE (see Figure 2). These were analysed in order to determine whether they contained an explicit or conceptual definition.

Table 3 shows the number of definitions (see also Appendix A) extracted from Google and scientific databases.

Definitions dated back to the year 1957.¹⁵ Definitions ranged in length from 1116 to 146 words.¹⁷ Most of the definitions were from the US. See Table 4 for the number of definitions from various countries and regions. Other terms closely related to HIE found were 'electronic data interchange',^{18–20} 'clinical information exchange',^{21–26} 'clinical document exchange',²⁷ 'clinical HIE',^{28,29} 'healthcare information exchange',^{30–35} 'medical data exchange',³⁶ and 'information exchange'.³⁷

KEY THEMES IDENTIFIED

The objective of facilitating exchange of health information among different systems or stakeholders was represented in the majority of definitions (See Appendices A and B).

The analysis of the included definitions revealed 11 main conceptual themes. In Table 5, these are arranged according to their frequency in the corpus of included definitions, while

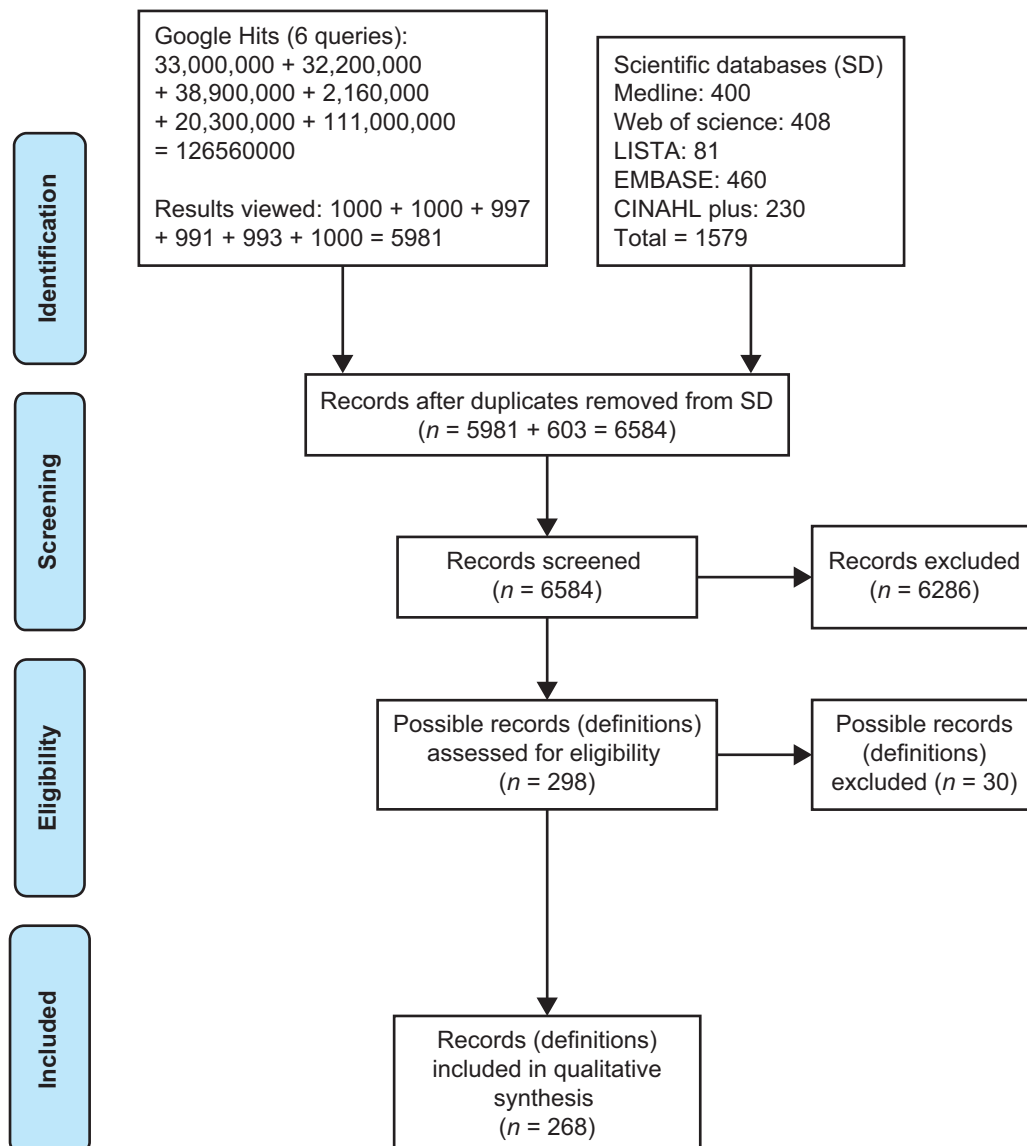


Figure 2 PRISMA diagram of HIE scoping review

Table 3 The number of definitions retrieved and extracted

	Google	Scientific databases	Total
Eligible definitions	165	103	268
Ineligible descriptions	9	21	30
Total	174	124	298

Table 4 The number of HIE definitions from different countries and regions

Country	Number of definitions
United States	<i>n</i> = 240
United Kingdom	<i>n</i> = 5 ^{22,38–41}
Australia	<i>n</i> = 3 ^{20,42,43}
The Netherlands	<i>n</i> = 3 ^{5,19,44}
Canada	<i>n</i> = 2 ^{45,46}
Denmark	<i>n</i> = 1 ⁴⁷
European Union	<i>n</i> = 1 ⁴⁸
Germany	<i>n</i> = 1 ⁴⁹
Israel	<i>n</i> = 1 ⁵⁰
New Zealand	<i>n</i> = 1 ⁴⁹
Portugal	<i>n</i> = 1 ⁵¹
Sweden/Finland	<i>n</i> = 1 ⁵²
Switzerland	<i>n</i> = 1 ⁵³
(Unknown)	<i>n</i> = 7

Figure 3 represents them in terms of themes and sub-themes (not in the order of frequency). A more detailed breakdown of subthemes and their frequencies may be found in Appendix B.

(Many definitions embedded a range of concepts and were thus tagged with more than one code or theme.)

The concepts represented within each higher order theme are described below.

Usage of data and information

The theme 'data and information' was divided into sub-categories that included 'healthcare information', 'health records', 'claims and administrative' and 'demographic data.'

Health care information

Definitions referring to the types of information that could be shared, accessed or exchanged are given in Box 1.

Table 5 Themes evolved and the frequency of their occurrence

Themes	Frequency of occurrence in %
Usage of 'data and information'	91%
'Information transfer as a function'	89%
'Stakeholders' involved in HIE	75%
'Potential benefits' of HIE	69%
'Technology' required for HIE	40%
'Focus'/'Context of use'	34%
'Data standards'	30%
Connectivity between different 'locations'	26%
'Public health' outcomes	12.6%
'Business'solutions/objectives of HIE	8%
'Sectoral or Regional Scope'	3%

Box 1 Terms used to represent healthcare information

'Health information',^{2,5,45,49,54–98} 'clinical information',^{21,33,37,46,61,71,88,97,99–120} 'clinical data',^{23,30,33,87,110,111,121–131} 'health data',^{17,24,43,69,70,76,100,132–140} 'patient data',^{31,33,55,107,141–145} 'healthcare information',^{35,72,84,110,115,126,146–148} 'clinical patient data',^{1,149} 'patient clinical data',¹⁵⁰ 'patient health information',^{151–158} 'patient information',^{16,26,29,40,41,47,66,97,116,159–165} 'medical information',^{21,28,34,97,107,129,166–171} 'health-related information',^{16,81,82,121,163,172–182} 'patient-medical information',^{183,184} 'personal health information',¹⁸⁵ 'clinical and demographic data',^{186,187} 'healthcare-related data',^{188–190} 'health surveillance data',¹⁹¹ 'clinical and other patient data',¹⁴⁵ 'surgical procedures',⁴² 'International Classification of Diseases',⁴² and 'diagnostic codes and record episodes'.⁴²

Health records

Healthcare information was categorised into various types of health records as given in Box 2.

Box 2 Terms used to represent types of health records

'Paper records',¹⁶¹ 'provider health records' and 'state registries',⁷⁹ 'digital medical records',¹⁹² 'electronic medical record' (EMR),^{113,165,191,193–198} 'EHR',^{5,57,67,81,107,136,162,169,179,199–209} 'health information records',¹³⁰ 'care records',²¹⁰ 'personal health record' (PHR),^{114,194} 'patient health records',²¹¹ 'electronic patient records',²¹² and 'patient clinical records'.⁵¹

Further, the contents of healthcare information and health records included are given in Box 3.

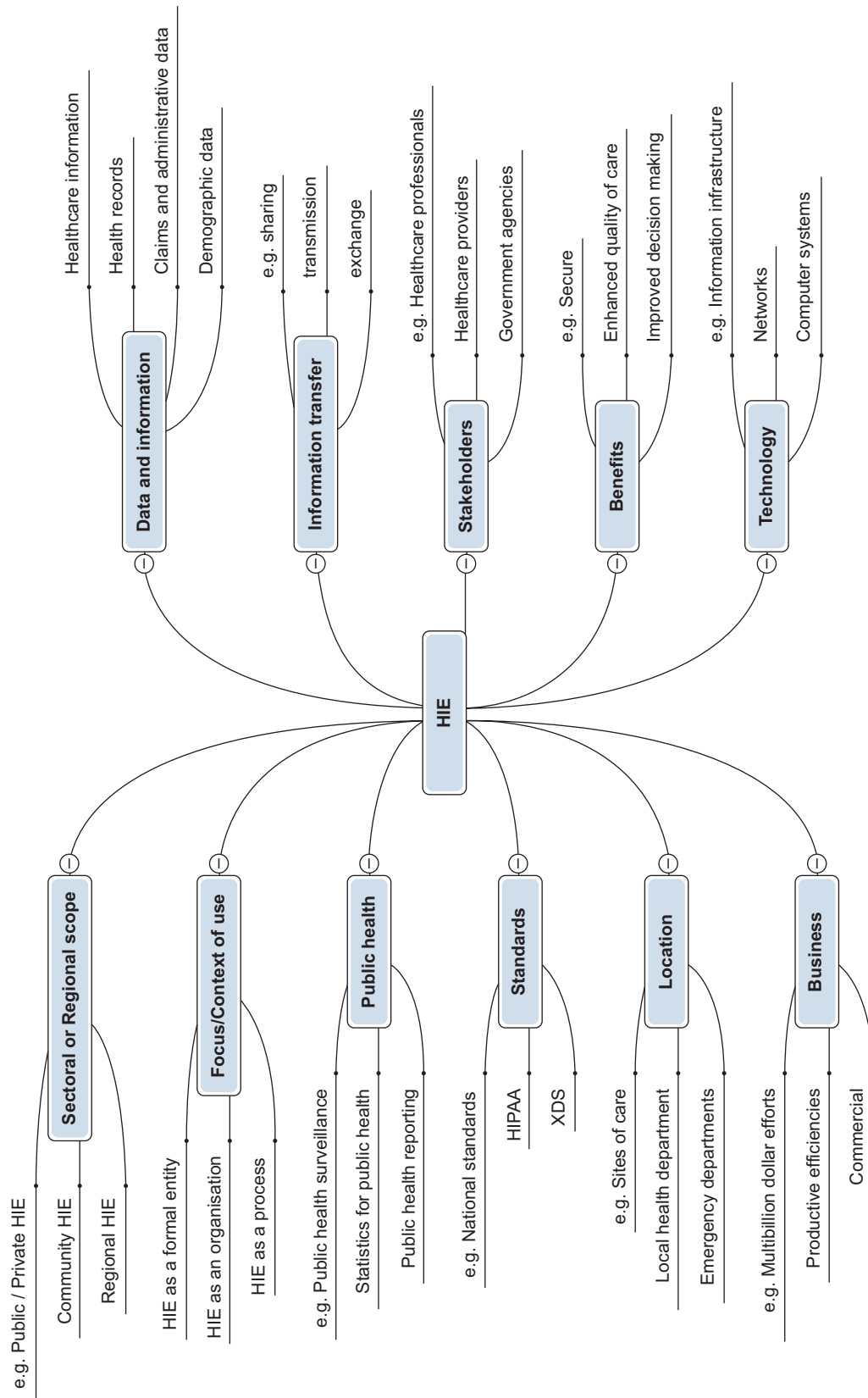


Figure 3 HIE themes

Box 3 Terms used to represent 'contents' of healthcare information and health records

'Problem lists',^{41,105} 'illness',^{96,185} 'injuries',⁹⁶ 'procedures',^{42,105,126,158,184} 'test results',^{88,96,105,185,213,214} 'radiology reports',^{88,207,215,216} 'allergies',^{88,96,105,131,185} 'images' and 'prescriptions',^{41,184} 'medicines',^{96,185} 'medications' lists,^{41,88,105,126,131} 'hospitalization summaries',⁸⁸ and 'discharge summaries',^{94,105,195}

Claims and administrative data

Other health information involved claims and administrative data (see Box 4).

Box 4 Terms used to represent claims and administrative data

Claims related to 'health insurance and payments',²⁰ 'claims information',²¹⁷ and 'health encounter claims',⁷⁹ whereas administrative data were labelled as 'administrative health data',⁶⁹ administrative data,¹⁶⁸ 'administrative information',^{117,198} and 'orders'.¹⁶⁵

Demographic data

Demographic items such as name, date of birth, address and insurance of the patients were exchanged along with the clinical information.^{27,42,88,186,187}

Information transfer as a function

Nearly, all the included definitions referred to health information are being exchanged through electronic processes. Words and expressions used to describe this process or its direction are given in Box 5.

Box 5 Terms used to represent information transfer

'Exchange',^{55–57,141} 'access',^{69,82,138,207,218–220} 'movement',^{154,163,172,173,175–177,221} 'sharing',^{2,59,99,200,222} 'multi-directional transfer',²²³ 'moving',^{127,224,225} 'bi-directional',^{47,191,194} 'mobilizes',²²⁶ 'connectivity',⁵⁴ 'data flow',¹²² 'transferring',^{55,61} 'transfer',^{58,70,109,112,11} '5,133,160,216' 'feed data repositories',¹⁰⁹ 'transmission',⁷ '6,80,186,188,189,217,227,228' 'transport',^{49,100,184} 'moves',¹⁶² 'access to and retrieval',^{87,110,111,115,121,130,160} and 'link'/'linking'.^{191,229–231}

Further, health information was being exchanged and transferred through different mediums and methods such as 'e-transfer',⁵⁵ 'application-level communication',⁴⁹ 'email',^{195,210} and 'secure messaging'.¹⁹⁶

Stakeholders involved in HIE

The third theme related to the range of stakeholders engaged in HIE, as shown in Box 6:

Box 6 Terms used to represent different types of stakeholders involved in HIE

'Doctors',^{67,69,85,96,142,156,166,179,184,185,232–234} or 'physicians',^{21,77–79,123,144,162,235–237} 'clinicians',^{1,56,87,97,99,109,131,135,161,213,218,238–240}

'nurses',^{85,166,184,234,241,242} 'patients',^{5,38,90,109,133,138,206} 'pharmacists',^{66,166,184} 'health educators',⁶⁶ public health officials',¹³³ 'healthcare professionals',^{29,33,36} 'medical professionals',⁹⁰ 'insurers',¹⁴² 'payers',^{69,77,175,217,243} 'policy makers',²³³ 'social workers',⁶⁶ 'healthcare providers',^{25,58,90,105,126,141,152,154,170,196,197,205, 208,222,230,244} 'customers',⁴⁴ 'hospitals',^{19,23,99,101,120,123,222,245} 'health plans',^{21,67,78,79,171} 'laboratories',^{67,77,85,246} 'radiology centres',⁸⁸ 'pharmacies',^{33,67,85,131,142,162,163,183,235,246,247} 'hospitals',^{21,32,124,184,195,215,222,237} 'organizations',^{134,22} '3,226,248,249' 'institutions',^{34,36,44,99,141,250–252} 'emergency departments',^{25,128,142,213} 'nursing homes',^{101,123} 'clinics' (ambulatory/community),^{32,79,114,120,124,216} 'quality assurance groups',¹¹⁴ 'government agencies',^{18,188–190} 'state agencies',⁷⁹ 'public health agencies',^{84,101,174,175,237,243} 'public health facilities',⁷⁹ 'public health entities',¹¹⁴ 'health information organizations',^{188–190} 'insurance companies',^{18,33} 'research groups',¹¹⁴ 'public health departments',¹²³ and 'federal reporting entities'.²⁵³

Some descriptions of stakeholders were more general, as shown in Box 7:

Box 7 Other terms for stakeholders

'Stakeholders',^{52,68,74,84,106,117,126,127,181,254} "multi-stakeholders",^{69,92,195,241} 'public-private stakeholders',⁹¹ 'public health stakeholders',²⁵⁴ "other or third parties",^{17,143} and "other healthcare providers".^{25,154}

Potential benefits of HIE

Many definitions emphasised the benefits and potential benefits of using HIE, although these were framed in different ways. The dominant benefit was being able to transfer information in a secure way (see Box 8). Other themes related to healthcare quality, timeliness, improved decision making and patient centredness.

Box 8 Terms used to represent potential benefits of HIE

Information security,^{25,30,43,60,70,89,95,98,100,127,153,157,164, 173,182,191,198,227,234,238,255} 'coded',^{41,195} improved capacity for informed 'decisions',^{17,27,38,47,65,69,83,109, 116,152,229,245,247,253} 'effective',^{21,71,103,115,121,129,160,234,252} 'efficient',^{33,84,95,121,148,160,233–235} 'safer',^{37,71,87,110, 111,121,233} 'coordinated',^{81,234} 'equitable',^{37,71,110, 111,115,121,129,130} 'timelier',^{103,121} patient-centred healthcare,^{37,71,84,110,111,115,121,129,130} 'real-time' information transfer,^{27,99,139,164,198,256} enhance 'quality' of healthcare,^{53,59,106,132,141,213,257} reduce costs,^{2,146,177,216,250,258} deliver 'accurate',^{97,107,213,247} 'seamless',^{47,99,140,255} 'empowerment',⁹³ and 'complete',^{27,97,118,144,150,161,212,222,240,259} health information.

Technology required for HIE

Almost all of the definitions referred to 'electronic' or 'digital' data exchange. Most referred to the information infrastructure, systems or technology platforms used to host, transfer

or exchange these data. Other related terms included those in Box 9.

Box 9 Terms used to represent information technology

'Technology platform',^{43,47,165,225,260} 'network infrastructure',^{42,102,109,126,131,219,227,249,260–269} 'health information technology',^{154,172,189} 'computer-based systems',²²⁶ 'technology model',¹²⁶ 'information technology',^{52,65,81,147,248,259,270} 'HIE systems',^{271,272} 'document exchange system',^{26,27,253} use of 'online metadata registry',²⁴² 'powerful technology',²⁷³ 'Web-based delivery systems',²¹⁵ 'technical infrastructure',^{133,267} 'information infrastructure',²⁷⁴ 'electronic networks',¹⁰⁶ 'electronic system',¹⁵² 'portal',⁴¹ 'computer network',¹⁸⁷ 'interoperable technologies',²⁷⁵ 'central information systems',¹⁵⁹ 'collection of activities and technologies',^{104,276} 'component of innovative',²⁷⁷ 'friendly user interfaces',²⁷⁸ 'secured website',^{116,170} 'communication based on Web services',⁵¹ 'health care technology',⁹⁶ 'health information systems',²⁶⁵ 'mobile computing technology',¹¹⁹ 'hubs',¹³⁶ 'open source',²³¹ and 'data formats'.²⁴⁹

Focus/context of use

Different definitions also considered HIE with reference to its different contexts of use (see Box 10).

Box 10 Examples of HIE in different contexts of use/focus

- For instance, 'nursing interventions',²⁷⁹ 'registered nurses' working in home healthcare improving the quality of care through HIE,²⁴¹ contributing to 'emergency departments',^{24,119,124,142,161,213,239} and focusing on preventive and outcome-based medicines.¹⁵⁸
- HIE was also used for occupational health,¹⁵ mental health,²⁸⁰ HIV,^{66,230} cancer care³¹ and cardiac surgery.¹¹⁹
- It is also referred as a 'set of activities' to transfer information from one place to another,^{201,281} as a component of eHealth,^{43,246} as a method of utilising EHR,^{81,144,169,204,209} or electronic patient record²¹² and as an important requirement of Stage 1 'meaningful use' for hospitals.^{75,105,203,209,282}

HIE was seen as an entity, organisation as well as a process as described below.

HIE as an entity or organisation

In many definitions, HIE was labelled as an 'entity',^{60,70,73,74,77,83,143,227,283} that was established to exchange health information in a secure manner. It has also been prefixed as 'legal entity',⁶⁰ and 'person or governmental entity'.²²⁷ In some definitions, HIEs were conceived as 'organisations',^{186,284} or sets of organisational 'services' and infrastructures to support or streamline the exchange of health information.^{72,149,165,197,206,285,75,263,267,130} Other organisational concepts/terms used under this theme are given in Box 11).

Box 11 Examples of HIE used as an entity or organisation

- Here HIE was used as a 'noun', to describe an entity responsible for the exchange of health information.^{186,217,284} The term HIE was synonymously interchanged with local health information organisations,¹⁸¹ regional health information organisations (RHIOs),^{23,45,50,63,72,102,181,207,286} and sub-network organisations,¹⁸¹ though different names but serving the same purpose. Others perceived that HIEs were run and controlled by RHIOs,⁶³ and were funded by healthcare delivery organisations.¹¹⁷
- HIEs were occasionally recognised as multi-stakeholder organisations responsible for managing business and legal matters involved in the exchange of information.⁶⁹ Moreover, HIEs were even regarded as the foundational part of accountable care organisations (ACOs)¹¹³ because they allowed EMRs to exchange information between various types of medical records. The other way around, HIEs were important for organisations that are transitioning into ACOs.⁹⁴

HIE as a process

Here HIE was considered as the procedure involved in transferring electronic or digital health data in a protected environment among multi-stakeholders.^{68,81,145,178,180,200,223,224,235,261,283,284} Moreover, it was the process of utilising technology and systems to capture, store, share and retrieve the data electronically.^{35,48} In a few definitions, HIE was also reflected as a 'verb', an action, a process responsible for transmitting health information,^{17,186,217,284} and collaboration among providers.^{21,32,94,117,171}

Data standards

Incompatibility between systems and software has presented a barrier to HIE, and for this reason, the importance of interoperability standards is emphasised in the majority of definitions. Keywords and phrases related to this are given in Box 12.

Box 12 Terms used to represent the use of data standards

'Standards',^{180,201} 'nationally recognized standards',^{100,121,137,154,173,175–177,228,283} 'nationally recognized vocabularies',¹⁹⁵ 'policies and standards',¹³³ 'standardise',^{149,152,208,254} 'standardized content',⁴⁹ 'standard procedures',¹²⁹ 'nationwide standards',²⁸³ 'national standards',^{153,188–190} standards-based infrastructure',³⁰ 'standard-based exchange/solution',^{36,238} 'cross enterprise document sharing (XDS)',¹⁸⁶ to 'Health Insurance Portability and Accountability Act (HIPAA) standards'.⁸⁹

Connectivity between different 'locations'

Definitions falling within this theme emphasised the exchange of information among facilities or organisations located in different areas (see Box 13).

Box 13 Terms used to represent different locations

Such as within a 'region',^{2,21,52,69,72,76,87,110,115,145,147,162,163,171,231,233,257} or at a 'regional level',^{5,40,44,55,75,82,83,271,283} 'community',^{2,31,69,82,102,109,124,165,247,287} 'non-clinical settings',⁶⁶ 'metropolitan regions',¹²⁴ 'sites of care',¹⁵⁰ 'delivery settings',^{54,59} 'city',²³³ 'state/statewide',^{21,40,82,131,156,164,168,191,203,205,233} 'member sites',²⁶⁷ 'geographic area',^{51,68,72,74,138,145} 'provincial',⁴⁰ 'local level/local health departments',^{32,75,139,271} 'national level',^{40,44,75,271} 'across countries',⁷⁶ 'neighbourhood/neighbouring states',^{168,283} 'multi-state',⁸³ and 'nationwide'.^{57,256,283}

Public health outcomes

The uses of HIE in population health were stressed in a number of definitions.^{97,127,165,255,288} Relevant concepts covered the uses of HIE for supporting public and community health practices, population health monitoring and research (see Box 14).

Box 14 Terms used to represent public health functions of HIE

Concepts included connecting 'public health departments',^{122,139} supporting 'public health practices',²⁵⁴ undertaking 'public health activities',¹⁵⁰ linking 'public health surveillance data',¹⁹¹ 'public health reporting',^{148,253} evaluation and planning of 'public health services',¹⁴⁸ 'public health event-monitoring capability',²⁵⁶ 'public health situational awareness',²⁵⁶ analysing the 'health of the population',¹¹⁰ 'countrywide population health',¹¹⁵ 'statistics for public health',⁷² assist 'public well-being',²⁸³ protecting 'public interest',⁹¹ 'public health organizations',³² promote 'population health',^{65,109,141,148,243} health data on a 'population level',¹³⁹ 'track population health',²⁵³ refine 'US health care system',^{56,74} HIE for a '16-county region',¹⁷¹ and 'community betterment'.^{87,168}

Business solutions/objectives of HIE

A number of definitions conceived of HIE as either a commercial solution facilitating information exchange or in terms of its business objectives.²⁸⁹ It was suggested that HIE will come up with their viable business plans when stimulus funding from the government will end.²⁹⁰ See more examples of HIE business solutions/objectives are given in Box 15.

Box 15 Examples of HIE as business solutions/objectives

- One vendor represented itself as a national HIE 'company',²⁹¹ while other definitions emphasised issues like scalability and efficiency.²⁵⁸
- Siemens offered a four-dimensional HIE 'solution', organised according to 'economics', 'care', 'service' and 'technology'.¹⁹⁸

- Transactions between providers or between services or suppliers often involve secure data exchange.^{17,100} This may be conceived in terms of 'data supplier and data receiver'¹⁷ but also 'competitors',⁴³ and 'customers'.⁴⁴
- HIE has been spoken about in terms of exchanging health information across traditional business boundaries⁶² and also characterized as 'large multi-billion dollar efforts'.²⁵²
- HIE has also been characterised as an infrastructure that includes business models, technology model and the legal model to facilitate the exchange of information among various organisations.^{91,126}
- The 'primary business focus' of networks involved in building HIEs was to create value for the provider community by forming 'productive efficiencies'.¹⁰²
- One of the authors termed HIE as entities built on 'bilateral legal agreements' between proprietary information systems to be able to share different kinds of data.¹⁷⁷ HIE is seen as an administrative as well as a clinical tool,^{27,117,168} and as a tool for exchanging insurance information.²⁹²

Sectoral or regional scope

Many definitions conceived HIE in terms of sectoral, geographic or occupational scope (see Box 16)

Box 16 Terms used to represent sectoral or regional scope of HIE

'Public' HIE,¹⁶⁵ 'private' HIE,¹⁶⁵ 'local' HIE,^{133,150} 'regional' HIE,^{133,215} 'national' HIE,²⁹¹ 'nationally accessible electronic record',³⁹ and 'community' HIE.²¹⁴

DISCUSSION

The analysis has revealed considerable variability among existing definitions of HIE and insights into the range of concepts that are embedded within these definitions.

Many definitions included not only the exchange of patient information but also other types of information such as demographics, claims and administrative data. Definitions also described health information sharing and connectivity at the level of organisations, states or regions and nations, possibly reflecting the different ways in which care is organised in different national contexts.

While the US government has provided incentives for the adoption of HIE, securing long-term funding is a major challenge for sustainability. Implementing HIE represents an investment and not simply a cost and this is accompanied by a realisation that policy makers must find approaches to assure that all stakeholders who benefit from HIE pay to support it and specifically that efforts should be made to engage private payers.²⁹³

A wide variety of stakeholders are engaged in HIE, not only including healthcare professionals and patients but also policy makers, researchers, and insurance companies,

for example. Although infrastructural, economic, technical and cultural barriers have impeded the participation of some stakeholder groups in HIE efforts, it remains the core of the vision for a connected, coordinated and learning health system.²⁹⁴

Not surprisingly, the majority of definitions highlighted the importance of secure information exchange and many pointed to the requirement for common data standards necessary for the quality of data content, clinical documentation, data mapping and, most importantly, interoperability between disparate systems.²⁰¹ Common standards will also ensure data protection, confidentiality, interoperability and privacy.^{29,129,189,228}

The value of HIE for supporting public health is referred to in many of the definitions, with the ability to meaningfully move clinical data across disparate systems being seen as vital for effective health surveillance and management of care delivered outside health facilities.²⁹⁵

Strengths and limitations

This review aimed to identify, classify and map definitions of HIE and was not intended as an in-depth analysis of the challenges and opportunities presented by HIE, although such issues were inevitably reflected in many of the definitions. The search terms used to identify definitions of HIE were limited to those that we considered most relevant and it is possible that extending them to include other pertinent concepts in health informatics might have revealed further descriptions of HIE and HIE-like concepts. However, we have followed previous authors in prioritising the search for explicit definitions, as a means of generating insights into how the concepts has evolved and how it is being discussed.^{8,12} Using both research databases and a general web search engine gave us greater scope to reach both academic and non-academic literature. Internet searches were restricted to Google and while it is possible that additional definitions may have been found using other search engines, the very large number of hits produced by our queries suggests that it was an effective means of identifying the majority of relevant content in the online grey literature.

The included definitions reflect the dominance of the US literature pertaining to HIE and, to some extent, the language used to describe information sharing concepts in that national context. We acknowledge this limitation, interpreting it as a consequence of the major investment in HIE in the US over recent years, with its inevitable knock-on effects on the volume of literature emerging from that part of the world. As the term gains wider international currency and other countries prioritise investments in HIE, this national balance may change. Nevertheless, a post-hoc analysis excluding the US definitions revealed similar themes as found across our entire corpus of 268 definitions, which encompasses research pre-HIPPA, suggesting that that the concept and function of HIE is similar in different parts of the world and has consistencies over time (Table 6).

Table 6 Weightage of themes excluding US definitions

Themes	Frequency of occurrence in %
Usage of 'data and information'	90%
'Information transfer as a function'	90%
'Stakeholders' involved in HIE	71.4%
'Technology' required for HIE	57%
'Potential benefits' of HIE	47.6%
'Data standards'	28.5%
Connectivity between different 'locations'	23.8%
'Focus'/'context of use'	23.8%
'Business' objectives of HIE	9.5%
'Public health' outcomes	4.7%

Implications for research, practice and policy

The definitions of HIE appearing in the literature vary on a number of philosophical and conceptual attributes, and many are context specific. The ways in which different authors choose to describe concepts is inevitably influenced by their backgrounds and vested interests and it is therefore not surprising to observe the differences in emphasis. However, we were struck by the clear alignment of the HIE concept with specific technologies or business opportunities in some definitions, where HIE is used describe a service, an organisation or a technology, rather than a process or concept. Such a language was often used by businesses promoting their products or in the context of state information systems, where 'the exchange' is pictured as an operational entity. This creates important obstacles to communication about HIE, particularly for policymakers involved in making decisions about strategy and procurements.

We have not found a single definition that encompasses all of the key attributes of HIE identified by our thematic analysis. The one suggested by Finn⁶⁹ is one of the most comprehensive and differentiates 'HIE' as a concept related to the processes of data transfer and sharing, and 'HIEs' as entities responsible for overseeing effective HIE, while also recognising the benefits, scope and stakeholders involved.⁶⁹ The broad concept of HIE also describes a set of enabling technologies that support these processes, including data standards and public health objectives. The use of HIE as a noun describing organisational entities concerned with mediation and governance of information transfers is largely, although not exclusively, a US phenomenon and also qualitatively different from process-oriented definitions. It has therefore has been placed in separate sentence. Based on our review, we proposed the following integrated definition of HIE shown in Box 17, which is a heavily adapted version of the one proposed by Finn.⁶⁹

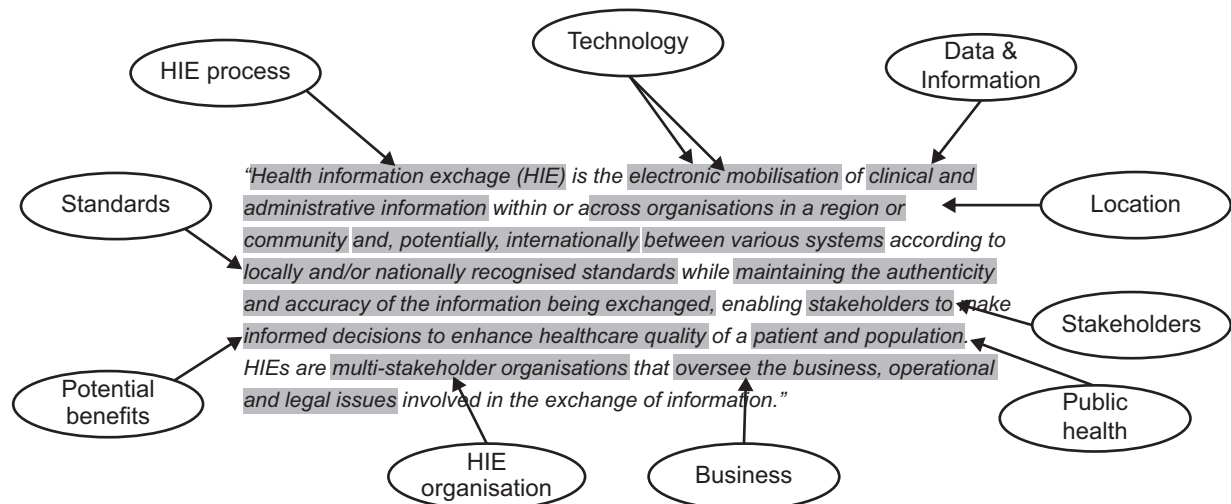


Figure 4 Proposed HIE definition composed of themes identified

Box 17 Adapted and proposed HIE definition

'HIE is the electronic mobilisation of clinical and administrative information within or across organisations in a region or community and, potentially, internationally between various systems according to locally and/or nationally recognised standards while maintaining the authenticity and accuracy of the information being exchanged, enabling stakeholders to make informed decisions to enhance healthcare quality of a patient and population. HIEs are multi-stakeholder organisations that oversee the business, operational and legal issues involved in the exchange of information.'

While this definition may not be ideally suited to all contexts (such as HIE for specific diseases and/or community HIE), we believe it provides a good overall fit with the themes identified in the heterogeneous corpus of definitions revealed by our review and therefore propose it for possible wider adoption (see Figure 4).

CONCLUSIONS

This review has shed light on the different facets of HIE. In the spirit of promoting further scholarly discussion and debate, we have proposed a definition that encompasses the key underpinning constructs. We recommend that future authors consider the findings of this review before developing new definitions of HIE, in order to avoid adding further heterogeneity. We also hope the review has value for policymakers involved in planning, procurement and evaluation of HIE.

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Appendix A: Extracted Definitions

S.No.	Author	Source	Year of Publication	Country	Definition
1.	1 st PC (178)	Web page: 1 st Providers Choice, Solution Provider	Unknown	US	Health Information Exchange (HIE) refers to the process of reliable and interoperable electronic health-related information sharing conducted in a manner that protects the confidentiality, privacy, and security of the information.
2.	4Med (188)	Web page: Educational Resource for Healthcare Information Technology	Unknown	US	Health Information Exchange (HIE) represents the transmission of healthcare-related data among facilities, health information organizations (HIO) and government agencies according to national standards. HIE is an integral component of the health information technology (HIT) infrastructure under development in the United States and the associated National Health Information Network (NHIN).
3.	Abhyankar et al (215)	Scientific	2010	US	Some regional health information exchanges (HIEs) provide web-based delivery systems that accept lab results messages from many sources (e.g. hospital laboratory, stand-alone radiology services) and deliver them in a uniform format to physician offices.
4.	Accenx (165)	Web page: Healthcare information technology & IT strategy news	2009	US	The Accenx Exchange is a health information exchange (HIE) services platform that brings the medical records in any given community much closer together by actually extending the reach out to the physician practices, hospitals and other healthcare organizations. It allows public or private HIEs to immediately establish a technology and service platform for sharing clinical results, orders and other patient information among providers using virtually any EMR system - or no EMR at all.
5.	Adler-Milstein et al (122)	Scientific	2011	US	Central goal of the legislation was to promote broad-based electronic HIE, in which key clinical data flow among providers and between providers and other stakeholders, such as public health departments.
6.	Adler-Milstein et al (54)	Scientific	2011	US	Health information exchange enables patients' health information to follow them between delivery settings in order to support care coordination and avoid duplication of services. There is broad consensus that such connectivity is critical to improving care and reducing healthcare costs.
7.	Adler-Milstein and Jha (123)	Scientific	2012	US	Health information exchange (HIE) is the act of sharing clinical data among health care practitioners and practice settings (physicians, hospitals, nursing homes, etc) who are not part of the same organizational entity.

S.No.	Author	Source	Year of Publication	Country	Definition
8.	Adler-Milstein et al (55)	Scientific	2013	US	Health information exchange (HIE) refers to the process of electronically transferring, or aggregating and enabling access to, patient health information and data across provider organizations. Exchange may take place between different types of entities, for example, e-transfer of patient data between ambulatory care providers or e-transfer of data at the regional level.
9.	AeHN (16)	Web page: Alaska eHealth Network	Unknown	US	Health information exchange (HIE) is the electronic sharing of health-related information.
10.	Afzal (71)	Conference: Maryland's Health Information Exchange. SOA in Healthcare Conference. The Role of Health Information Exchange in Driving Toward Interoperability	2011	US	Health Information Exchange, or HIE, allows clinical information to move electronically among disparate health information systems. The goal of HIE is to deliver the right health information to the right place at the right time—providing safer, more timely, efficient, effective, equitable, patient-centered care.
11.	AHA (245)	Report: Health Information Exchange Projects What Hospitals and Health Systems Need to Know by American Health Association	Unknown	US	Health information exchange enables hospitals to bring better information to the point-of-care and enhances opportunities for clinical decision support.
12.	AHIMA (176)	Web Page: American Health Information Management Association	Unknown	US	An HIE is the electronic movement of health-related information among organizations according to nationally recognized standards. HIE is also sometimes referred to as a health information network (HIN)
13.	Alert (51)	Web page: Alert HIE, Provider		Portugal (Head Office)	ALERT® HIE is an integration infrastructure that provides the ability to access patient clinical records from different healthcare facilities located in different geographical areas.
14.	Altman et al (99)	Scientific	2012	US	HIE enables digital, clinical information sharing among disparate institutions, which allows for a more seamless transition of care between providers. With HIE, patients can have their existing clinical information viewed by providers across different healthcare organisations, keeping all of their providers informed. Using HIE, community clinicians can also follow their patients'

S.No.	Author	Source	Year of Publication	Country	Definition
					interactions with participating hospitals in real time.
15.	AMA (74)	Web page: American Medical Association	Unknown	US	Health Information Exchanges (HIEs) are entities that bring together health care stakeholders within a defined geographic area and govern the electronic sharing of health information among them for the purpose of improving health and care in that community. The fundamental concept behind creating HIEs is that the ability to exchange health information electronically is critical to the efforts to improve the US health care system.
16.	Amatayakul (181)	Web page: Healthcare Financial Management business journal	2008	US	HIE organizations go by different names-local health information organizations (LHIO), regional health information organizations (RHIO), sub-network organizations (SNO)--they serve the same purpose: to oversee and govern the exchange of health-related information among disparate stakeholders for the purpose of improving health and health care.
17.	Ancker et al (295)	Scientific	2012	US	Health information exchange (HIE), the exchange of electronic patient data among healthcare providers and institutions, is being promoted by national policy because of its potential to improve healthcare quality and efficiency, engage consumers, and promote population health.
18.	Arkansas OHIT (164)	Web page: Arkansas Office of Health Information Technology	Unknown	US	The Arkansas State Health Alliance for Records Exchange (SHARE) is a statewide health information exchange (HIE) that solves this problem. SHARE allows primary health care providers, related health services professionals, and public health authorities to access and exchange with each other real-time, electronic patient information that is secure and protected by current federal and state privacy and security laws. Through its implementation and use, SHARE will reduce medical errors and duplicate testing, promote improved management of chronic diseases, and improve patient care coordination among unaffiliated health care providers.
19.	Aspelin (75)	Web page / Post: Mark Aspelin, Health IT Manager / Writer	Unknown	US	Health Information Exchange (HIE) is a term that is used to describe the sharing of health information electronically among two or more entities. The term is also used to describe an organization that provides services that enable the electronic sharing of health information. The concept of a health information exchange is a critical element of Meaningful Use, and the future of healthcare reform at the local, regional, and national level.
20.	Axolotl Corp. (168)	Web page: Axolotl Corporation provider for browsing based-products	2009	US	NeHII is a statewide Health Information Exchange designed to share clinical and administrative data among providers in Nebraska and neighboring states. NeHII's purpose is to achieve health care transformation through community betterment collaboration while protecting the security and privacy of medical information.

S.No.	Author	Source	Year of Publication	Country	Definition
21.	Barton et al (42)	Scientific	2006	Australia	The HIE is the department's corporate network of data warehouses. It contains data on surgical procedures on inpatients and international classifications of diseases, 10th edition (ICD-10) diagnostic codes, and records episodes of care and contains information on diagnosis, procedures and some demographic items
22.	Birkle et al (34)	Scientific	2011	Germany	Healthcare Information Exchange Networks (HIEN) enables the exchange of medical information between different institutions.
23.	Bostick et al. (175)	Report: Sustaining Health Information Exchange: A State Toolkit by National Governors Association Center for Best Practices State Alliance for eHealth	2011	US	The term "health information exchange" (HIE) refers to the electronic movement of health-related information among organizations such as health care providers, public health agencies, and payers, according to nationally recognized standards.
24.	Bouhaddou et al (100)	Scientific	2012	US	Health information exchange (HIE) refers to the activity of secure health data exchange between two authorized and consenting trading partners. It is a secure data service that utilizes nationally recognized standards to enable electronic transport of clinical information among separate health care organizations that are motivated by common interests and governed by rules that ensure the rights of patients and participants are protected.
25.	Boyle (40)	White paper: Privacy Lessons Learned from an Operational Health Information Exchange by FairWarning	2011	UK	Health Information Exchanges (HIEs) which facilitate the electronic exchange of patient information between care providers at a provincial, state, regional or national level.
26.	Braithwaite (18)	Scientific	1998	US	Workgroup Electronic Data Interchange (WEDI), a coalition of representatives from various components of the health care industry, including insurance companies, managed care organizations, health care provider organizations, government agencies, and health care clearinghouses.
27.	Bredfeldt (216)	Scientific	2013	US	Electronic health information exchange (eHIE) facilitates coordination of care by enabling information transfer across providers and medical clinics. By increasing care coordination, eHIE is expected to reduce healthcare costs resulting from redundant lab tests and radiology studies.
28.	Bresnick (212)	Web page:	2013	Unknown	Health information exchange (HIE) makes many promises: a complete,

S.No.	Author	Source	Year of Publication	Country	Definition
		ehrintelligence.com for latest technology news and white papers / Article		n	structured, electronic patient record, available to any provider at the push of a button, instantly updated and always reliable.
29.	Bugge et al (38)	Scientific	2006	UK	Information exchange between patients and health professionals is fundamental to achieving patient participation in decision-making and shared decision-making is said to require the exchange of “all information relevant to decision-making”.
30.	Byers (15)	Scientific	1957	US	The Occupational Health Information Exchange will serve as a central agency for the collection, collation, and dissemination of all types of information pertinent to occupational health problems.
31.	Cannoy (35)	PhD Thesis: The Implications of HIE on Healthcare Consumers: The Case of Consumer Empowerment. Business Education Department, North Carolina A&T State University	2008	US	The capability to use technology to electronically exchange medical records is called Healthcare Information Exchange (HIE). HIE is the process of utilizing information systems and technology for electronic storage, retrieval, and sharing of healthcare information among participants in the healthcare system so that information is accessible at the point of care.
32.	Care Accord (184)	Web page: Oregon HIE	Unknown	US	Health information exchange (HIE) allows doctors, nurses, pharmacists and other health care providers to securely share a patient’s medical information electronically — reducing the need for patients to transport or relay their medical history, lab results, images or prescriptions between health care professionals. Instead, this information is shared between health care professionals before the patient arrives for an appointment or goes to the pharmacy. HIE can also reduce orders for duplicate procedures or tests because information is available where and when it is needed, as well as enabling smoother transitions of care because providers, hospitals and long term care facilities can more easily share information.
33.	Carter (286)	Scientific	2006	US	There are a multitude of terms currently used to describe a networked community of healthcare entities using interoperable electronic health record systems to exchange health information. These include regional health information organization (RHIO), health information exchange (HIE), the nationwide health information network, and at one time, community health

S.No.	Author	Source	Year of Publication	Country	Definition
					information network.
34.	CDC (111)	Presentation: Department of Health and Human Services, USA / Centre for Disease Control and Prevention Web page: eHealthserver News, GE Healthcare, a division of General Electric Company and global eHealth specialist InterComponentWare, Inc. (ICW) joint HIE	Unknown	US	HIE provides the capability to electronically move clinical information between disparate health care information systems while maintaining the meaning of the information being exchanged. The goal of HIE is to facilitate access to and retrieval of clinical data to provide safer, more timely, efficient, effective and equitable, patient-centered care.”
35.	Centricity (131)		2009	US	Centricity® Health Information Exchange services connects, stores and shares clinical data from hospitals, physician offices, pharmacies, labs and other sources to help improve communication flow between care providers and patients and clinicians. The resulting network enables state, government or healthcare delivery organizations to create a secure exchange to share patient conditions, allergies, medication history and other appropriate clinical data across the continuum of care.
36.	Cerner (238)	Web page: Cerner, Solution Provider	Unknown	US	Clinical Exchange Platform is a major Cerner Network offering that focuses on the secure exchange of critical patient summaries within the clinician’s workflow. Clinical Exchange Platform leverages a suite of open source solutions brought together by proprietary intellectual properties creating a low cost IHE Standards based exchange.
37.	Chaudhary (200)	Scientific	2012	US	Health Information Exchange (HIE) is the process of reliable and interoperable electronic health record (EHR) sharing, conducted in a manner that protects the confidentiality, privacy, and security of the information.
38.	Cisco (296)	Webpage: Cisco, Solution Provider	Unknown	US	The Cisco Medical Data Exchange Solution (MDES) is an integrated end-to-end, standards-based solution that facilitates patient-centric access to medical records. It gives healthcare professionals from multiple institutions access to patient data from previously disconnected systems with incompatible formats and disparate medical terminology. Now providers can quickly and easily access and review a patient’s medical data gathered by different applications and stored in separate locations.
39.	Citius Tech (253)	Web page: Technology and Solution Provider	Unknown	US	Health Information Exchanges (HIEs) offer significant opportunity for cross enterprise document sharing in healthcare – positively impacting both quality and cost of healthcare delivery. HIEs provide flexible data sharing capabilities with hospitals, public health and federal reporting entities. HIEs can also offer strong analytics and reporting capabilities to track population health and

S.No.	Author	Source	Year of Publication	Country	Definition
40.	C. Kibbe (138)	Web page / Post: The Society for Participatory Medicine, e-patients.net	2009	US	support a wide range of clinical decision support capabilities. Health information exchange between and among providers, especially when these providers are independent entities or exist in separate geographical locations, helps create continuity of patients' experience by providing continuity of information flow and access where once there were only isolated silos of health data. There is widespread belief that health data sharing could improve care, safety, and decrease waste and duplication.
41.	C. Livingood et al. (250)	Report: Public Health & Electronic Health Information Exchange: A Guide To Local Agency Leadership by The Institute for Public Health Informatics and Research Duval County Health Department	Unknown	US	The focus on electronic health information exchange (EHIE) emphasizes how data can best be shared and utilized across healthcare institutions and among providers to improve patients' health, improve the quality of care, increase efficiency, and reduce costs.
42.	Clemens (159)	Scientific	2012	US	Health information exchanges, in which all individual patient information is routinely and entirely managed through a central information system
43.	Clinical Connect (257)	Web page: Clinical Connect is a western Pennsylvania's first HIE	Unknown	US	ClinicalConnect is western Pennsylvania's first Health Information Exchange (HIE). A partnership of leading regional health care providers, ClinicalConnect will help to improve the safety, quality, and efficiency of care for patients throughout the region by securely connecting clinicians with patients' vital electronic medical records
44.	Codagnone (48)	A study prepared for the European Commission	2013	European Union	Health Information Exchange (HIE): is the process of electronically transferring / sharing / enabling access to patient health information and data.
45.	CORHIO (161)	Report: HIPPA and HIE by Colorado Regional Health Information Organization	Unknown	US	CORHIO's HIE makes it possible for providers to access and exchange patient information electronically, improving patient safety and reducing delays in care that can be caused when paper records are illegible, get lost, are accidentally destroyed by fire, flood or natural disaster, or are sent to the wrong fax machine or address. It also helps providers access more complete and up-to-date patient medical records, which is especially helpful in emergency situations or for patients who have a chronic medical condition for which they see many providers over the course of a year.
46.	CSC (43)	Web page: Healthcare Group / Service Provider	Unknown	Australia	CSC is taking a Health Information Exchange approach to enabling secure health data sharing between hospitals and other care providers.

S.No.	Author	Source	Year of Publication	Country	Definition
					CSC's approach to Health Information Exchange (HIE) provides not only a solution to enable the many and diverse CSC applications for the eHealth agenda but also an agnostic design that will allow our partners and competitors to leverage this platform.
47.	Daurio et al (101)	Scientific	2009	US	An exchange of clinical information between Brooklyn hospitals, nursing homes, and home health agencies that aids in the transition of care for its shared patients.
48.	Deas Jr and Solomon (263)	Scientific	2012	US	The term HIE is also used to describe formal organizations that provide the infrastructure for electronic exchange.
49.	De Brantes et al. (102)	Scientific	2007	US	Health information exchanges or regional health information organizations (HIEs or RHIOs) have emerged as vehicles to facilitate the flow of clinical information between providers in the community; they are building on the foundation laid by the pioneers in the field, the Indiana Health Information Exchange, the Inland Northwest Health System, HealthBridge and a few others. The primary business focus of these networks has sought to create value for the provider community by creating productive efficiencies. In doing so, they have been able to generate modest revenue, and therefore have achieved a modest but sustainable business model.
50.	Delfan (5)	Master Thesis: Computer Science Delft University of Technology	2013	Netherlands	Health Information Exchange (HIE) is a term used to describe the sharing of health information electronically among two or more entities. These entities are mostly organizations, which provide health services to their clients (the patients) and also enable the sharing of electronic health information. The exchange of medical data takes place primarily between different medical departments within the same health organization. This happens most of the time through an Electronic Health Records (EHR) system within the organization, but also across the organizational borders on the regional level (through Regional Health Information Systems, RHIS) or across the country (National EHR).
51.	Dimitropoulos and Rizk (279)	Scientific	2009	US	An interoperable system of HIE—that is, one in which various parties can share and exchange data among them.
52.	Dobbs et al (297)	Scientific	2010	US	HIEs would provide a unified view of a patient across health care providers and would serve as data collection points for clinical and resource utilization data.
53.	Downing et al (298)	Scientific	2010	US	Collaborative relationships among primary care and specialty providers and their patients and families can be enhanced through electronic HIE.
54.	Dullabh and	Scientific	2012	US	There is widespread consensus that Health Information Exchange, the

S.No.	Author	Source	Year of Publication	Country	Definition
	Hovey (59)				electronic sharing of patients' health information between delivery settings, is critical to improving the quality and efficiency of patient care.
55.	eHealth Initiative (280)	Report: Health Information Exchange: From Start Up to Sustainability by Foundation for eHealth Initiative	2007	US	"Health information exchange" describes a commonly understood activity: the sharing of patient care data between non-aligned health care organizations for the purposes of enhancing quality and efficiency.
56.	eHEalth Initiative (61)	2011 Report on Health Information Exchange: The Changing Landscape	2011	US	The act of transferring health information electronically between two or more entities.
57.	eHealth Privacy 360 (67)	Web page: California Government	2011	US	The electronic exchange of health information allows your health care information to be shared between health care providers. This exchange is done through the EHR system. Your health information may be exchanged between doctors, laboratories, hospitals, pharmacies, and other providers you have visited. Health information from your health plan may also be exchanged and used for your care.
58.	Emdeon (235)	Web page: Vendor / Solution Provider	Unknown	US	Emdeon connects physicians, hospitals, pharmacies and labs to securely exchange information when it can save the most money and provide the most benefit - right at the point-of-care. Emdeon, currently performing more than 6.4 billion health information exchanges per year, makes the process of sharing information easy, efficient and affordable.
59.	Excelicare (41)	Web page: Axsys Health, Excelicare Solution Provider	Unknown	UK	Excelicare™ Clinical Portal allows users to explore information relevant to the care of every patient, regardless of where it was first recorded. As a care-giver, the portal offers you a composite view of patient information, in a clinically relevant format, with hyperlinks that let you drill to underlying details. Laboratory results and outstanding orders, recent medications and prescriptions, x-ray images and reports from radiology, coded problem list, clinical notes from any specialty – all these are presented in an easy-to-access, relevant way. But it doesn't have to stop there. Referral and discharge letters, GP notes, appointments, assessments, clinical alters, and information from community health can be included.
60.	Finn (69)	Scientific	2011	US	Health information exchange (HIE) is defined as the mobilization of health care information electronically across organizations within a region or community. It provides the capability to electronically move health

S.No.	Author	Source	Year of Publication	Country	Definition
					information between various systems, while maintaining the authenticity and accuracy of the information being exchanged. This sharing of critical and administrative health data electronically enables a care team to make more informed decisions. HIEs are multi-stakeholder organizations that oversee the business and legal issues involved in the exchange of information. The stakeholders are diverse and generally include large doctor groups, solo practices, competing hospitals, and payers. Patients have been visibly absent from the discussions, interactions, and agreements that form and run these HIE organizations. Patient access to their own information from an HIE has also been limited, but that promises to change over time.
61.	Florida HIE (153)	Web page: Florida HIE	Unknown	US	The Florida Health Information Exchange (HIE) provides entities with timely, secure, and authorized exchange of patient health information. The services we offer are based on national standards for secure exchange of health information.
62.	Florida HIN (95)	Web page: Florida Health Information Network	Unknown	US	The Florida Health Information Exchange (Florida HIE) enables the secure exchange of health information. It allows authorized medical providers to quickly and efficiently review their patients' medical records to facilitate diagnosis and treatment.
63.	Forcare (44)	Web page: Dutch software company providing software products and service for healthcare	Unknown	Netherlands	A Health Information Exchange is a network, allowing our customers to exchange medical data to support key clinical processes. Examples include imaging networks, referral networks and communication to GPs. An HIE can be built around a single hospital, or can cover a regional or national group of healthcare institutions.
64.	Frankel et al (50)	Scientific	2013	Israel	The vertically integrated Clalit Health Services seeks to completely open information exchange between hospital and community care by providing a single medical informatics system across the spectrum of care.
65.	Frisse (60)	Scientific	2010	US	This model — often called a health information exchange — differs from others in that the collection of health information exchange services commonly is managed through a designated legal entity, and data may be accessed from a highly secure set of services that provides the performance and simplicity of a centralized database.
66.	Frisse et al (284)	Scientific	2012	US	HIE is a set of services that supports access among parties who are motivated by common interest and governed to ensure that the rights of patients and participants are protected.
67.	Furukawa et al (222)	Scientific	2013	US	Electronic health information exchange can improve care coordination for patients by enabling more timely and complete sharing of clinical information

S.No.	Author	Source	Year of Publication	Country	Definition
					among providers and hospitals.
68.	GAO (73)	Report: Health Care Entities' Reported Disclosure Practices and Effects on Quality of Care by United States Government Accountability Office Washington, DC 20548	2010	US	Health information exchanges—entities that were formed to facilitate the electronic sharing of patients' health information among providers.
69.	Gadd et al. (124)	Scientific	2011	US	Its goal was to create an HIE that meets the basic needs of an underserved metropolitan region through exchange of clinical data among hospital emergency departments and community-based ambulatory clinics.
70.	Gaebel (160)	Web page / Post : HIMSS HIE Wiki	Unknown	US	A Health Information Exchange (HIE) assists with the transfer and sharing of health related information that is typically stored in multiple organizations, while maintaining the context and integrity of the information being exchanged. An HIE provides access and retrieval of patient information to authorized users in order to provide safe, efficient, effective, and timely patient care.
71.	Gartner (117)	IT Glossary: Gartner, Inc. Research and Advisory Company	Unknown	US	A health information exchange (HIE) is a regional collaboration among independent healthcare organizations for sharing clinical information. Often, administrative information is shared as well. HIEs may be categorized in terms of their approach to governance. In some countries, they may be run by a governmental agency. Other HIEs may be run by nonprofit corporations with a board of governors that represent community stakeholders. Still others are lines of business of for-profit vendors. A final form of HIE is funded and controlled by healthcare delivery organizations (HDOs) to meet their own business concerns, rather than being neutral to all community stakeholders.
72.	Gassert (119)	Scientific	1996	US	Mobile computing technology (MTC) could provide older cardiac surgery patients with a portable computer system to be used at home for accessing, collecting and transmitting clinical information related to their recovery.
73.	Geissbuhler (53)	Scientific	2013	Switzerland	The transparency resulting from a streamlined exchange of information may improve the continuity, quality and efficiency of care, while, at the same time, reveal and challenge habits and practices of care professionals and of citizens.
74.	Genes et al (142)	Scientific	2011	US	Health Information Exchange (HIE) has the potential to improve patient care by bringing relevant patient data to the point of care. HIE seems particularly

S.No.	Author	Source	Year of Publication	Country	Definition
					promising in emergency departments (EDs), where patients frequently present outside their usual medical home and outside the normal hours during which primary care doctors, pharmacies or insurers can typically be reached
75.	Georgia HIV HIE (230)	Web page: HIV HIE, Georgia Department of Public Health	Unknown	US	HIE proposes to develop and implement a system to alert healthcare providers of a patient's "out-of-care" care status so that they can re-engage them in HIV care. By improving linkage to and retention in care, and encouraging adherence to antiretroviral therapies, HIE will support clinical efforts to reduce viral loads and achieve an "undetectable viral load" or viral suppression.
76.	Grannis et al. (254)	Scientific	2010	US	HIEs standardize, aggregate and streamline information sharing among data partners, including public health stakeholders, and HIE has supported public health practice in Indiana for more than 10 years.
77.	Greenhalgh et al. (39)	Scientific	2013	UK	A nationally-accessible electronic record (known in the USA as health information exchange).
78.	Grinspan et al.(23)	Scientific	2013	US	NYCLIX (New York Clinical Information Exchange), a regional health information organization (RHIO) that draws clinical data from several New York City hospitals.
79.	Grossman et al. (150)	Scientific	2008	US	Local health information exchanges (HIEs) hold the promise of collecting patient clinical data across sites of care to provide more complete and timely information for treatment, as well as supporting quality improvement and reporting, public health activities, and clinical research
80.	Gulf Coast(244)	Web page: Gulf Coast HIE / Company	Unknown	US	Health Information Exchange (HIE) is the term used to describe large-scale electronic communication of patient information between unaffiliated healthcare providers.
81.	Haggstrom and Doebbeling (251)	Scientific	2011	US	Information exchange offers the potential to pool a single patient's data across multiple institutions; conversely, information exchange allows institutions to aggregate their own data across multiple patients. Patient-level aggregation offers the promise of improving clinical care across a fragmented health care delivery system, while institution level aggregation has the potential of serving as a data infrastructure for quality measurement.
82.	Halamka (213)	Scientific	2013	US	Intuitively, health information exchange should improve safety, quality, and efficiency by providing emergency department (ED) clinicians with accurate lifetime medical histories, up-to-date test results, and evidence of previous problematic therapies. However, studies demonstrating these benefits are few.
83.	Hall (146)	Electronic Article:	2009	US	Broadly defined, a Health Information Exchange (HIE) exists whenever two

S.No.	Author	Source	Year of Publication	Country	Definition
		Diagnostic Intelligence and Health IT Initiatives College of American Pathologists			or more organizations share healthcare related information electronically. Exchanging healthcare information between organizations improves patient care and reduces costs by fostering collaborative care and reducing administrative burden.
84.	Harris (94)	Web page: Harris Healthcare Solutions	Unknown	US	Harris enables IDNs, physician practices, medical groups and other care providers to exchange health information as never before, empowering provider collaboration - send and receive results and discharge summaries, exchange information on orders, engage in clinical messaging and share documents. Such data exchange is increasingly important as organizations respond to delivery-system reform by transitioning to new models such becoming an Accountable Care Organization (ACO).
85.	Hasman et al. (19)	Scientific	1992	Netherlands	Electronic Data Interchange (EDI) is a reasonable substitute of the traditional mail for the communication between hospital and GP. It will lead to higher quality of data and to new applications that will enhance the quality of care.
86.	Hazamy et al. (26)	Scientific	2013	US	HEALTHeLINK, a clinical data exchange system to share patient information as a way to improve patient care.
87.	HC (162)	Web page: Greater Houston Health Connect, Greater Houston Health Information Exchange (GHHIE)	Unknown	US	A health information exchange is a network of electronic health records designed to link all providers in a specific region. With this network, patient information moves electronically between physicians, hospitals, labs and pharmacies.
88.	Healthcare IT (189)(189)(189)(189)(189)(192)	Web page: Healthcare IT News	Unknown	US	Health information exchange is the transmission of healthcare-related data among facilities, health information organizations and government agencies, according to national standards for interoperability, security and confidentiality. It is an important part of the health information technology (HIT) infrastructure under development in the U.S., and the associated National Health Information Network (NHIN).
89.	HealtheLink (21)	Web page: HealtheLink is a non-governmental, multi-stakeholder RHIO	Unknown	US	HEALTHeLINK, the Western New York Clinical Information Exchange, is collaboration among the region's hospitals, physicians, health plans and other health care providers to serve the eight counties of western New York State. HEALTHeLINK was created to enable the exchange of clinical information in secure and meaningful ways to improve both efficiency and quality, while also helping to control health care costs. Patients who provide consent allow physicians and providers directly involved in their treatment to securely access relevant medical information via HEALTHeLINK, resulting in more timely

S.No.	Author	Source	Year of Publication	Country	Definition
					and effective treatment at the point of care.
90.	Health Insights (205)	Report: Public Perception and Utah's Clinical Health Information Exchange, based on consumer focus groups conducted by Health Insights	2011-2012	US	One of the first state-run Health Information
91.	Health IT(166)	Web page: HealthIT.gov	Unknown	US	Health Information Exchange allows health care professionals and patients to appropriately access and securely share a patient's vital medical information electronically. There are many health care delivery scenarios driving the technology behind the different forms of health information exchange available today.
92.	Health IT(166)	Web page: HealthIT.gov	Unknown	US	Electronic health information exchange (HIE) allows doctors, nurses, pharmacists, other health care providers and patients to appropriately access and securely share a patient's vital medical information electronically—improving the speed, quality, safety and cost of patient care.
93.	Health Leaders (192)	Web page: Health Leaders is a multi-platform media company to meet the information needs of health professionals	2009	US	The Exchange is an electronic health information system that will allow for the exchange of digital medical records between healthcare facilities, doctors' offices, and the Kentucky Department.
94.	Health Unity (255)	Web page: Vendor / solution Provider	Unknown	US	The HealthUnity HIE solution provides a one-stop solution for enabling seamless bidirectional communication between a wide array of entities including various types of providers, patients as well as public health. Services we provide include secure messaging, record location service, analytics service, results delivery service etc.
95.	Hersh (62)	Scientific	2009	US	Health information exchange (HIE), which is the exchange of health information for patient care across traditional business boundaries in health care
96.	Herwehe et al (191)	Scientific	2012	US	The Louisiana Public Health Information Exchange (LaPHIE) is a novel, secure bi-directional public health information exchange, linking state-wide public health surveillance data with electronic medical record data.
97.	HHS (137)	Report: National Biosurveillance Strategy	2010	US	Electronic health information exchange is defined as the sharing of digitized human health data and information according to nationally recognized

S.No.	Author	Source	Year of Publication	Country	Definition
		for Human Health V2.0 by Centers for Disease Control and Prevention, US Dept. of Health and Human Services			standards among organizations that can utilize the information to improve individual and community health security.
98.	HIE Answers (151)	Web page: HIE Answers, Advancing Health Information / Online knowledge resource	Unknown	US	Health Information Exchanges are typically categorized by how a patient's health information is stored and how the legitimate members or participants can access patient health information.
99.	HIE Bridge (116)	Web page: A Minnesota certified HIE by a certified HIO	Unknown	US	HIE-Bridge™ is a Minnesota state certified health information exchange (HIE) allowing providers to locate and access key clinical information that is vital when making medical decisions. Through HIE-Bridge health providers have access to authorized patient information through a secure web-based information exchange platform.
100	HIECC (79)	Meeting: Meaningful Health Information Exchange by Health Information Exchange Coordinating Committee (HIECC) and State Electronic Prescribing Advisory Panel (SEPAP)	2009	US	“Meaningful health information exchange” refers to achieving a high level of participation in electronic health information exchange among hospitals, clinics, physicians, public health facilities, other health care providers, health plans and state agencies including data from health encounter claims, provider health records and state registries that has a measureable effect on community health care including improved efficiency of care (79)management processes, enhanced patient safety, increased effectiveness of care, and a measureable effect on population health including reduced disease incidence and prevalence.
101	HIE Nevada (247)	Web page: Health HIE Nevada, state-wide community HIE	Unknown	US	HealthHIE Nevada is the new state-wide community-based Health Information Exchange (HIE) that lets doctors' offices, hospitals, clinic, labs, pharmacies and other healthcare professionals easily access and share patient medical records quickly, securely and accurately at the point of care. The HIE helps Nevada health care providers improve the coordination and quality of patient care. Decisions can be made more quickly and with a greater understanding of patient history than ever before.
102	HIE Ohio (227)	Summary of Ohio Revised Code Chapter 3798	2012	US	Health Information Exchange is defined as “any person or governmental entity that provides in this state a technical infrastructure to connect computer systems or other electronic devices used by covered entities to facilitate the secure transmission of health information.”
103	HIMSS (173)	Report: Putting the HIE	Unknown	US	The electronic movement of health-related information among disparate

S.No.	Author	Source	Year of Publication	Country	Definition
		into Practice by HIMSS			organizations according to nationally recognized standards in an authorized and secure manner.
104	HIMSS HIE Committee (17)	Report: HIE Implications in Meaningful Use Stage 1 Requirements, by HIMSS	2010	US	In its most conservative definition, HIE (the verb) is the activity of secure health data exchange between two authorized and consenting trading partners. Data exchange occurs between any two trading parties—a data supplier and a data receiver. It can also be facilitated by one, two or more third parties who operate between the data supplier and the data receiver. To add complexity, a third party could also be storing data from and on behalf of the data supplier and be transmitting data on behalf of the data supplier (in such case, the third party would be considered to be the data receiver). Further, a third party could be receiving data on behalf of a data receiver. While this may be complex, HIE activity can enhance virtually any clinical function by virtue of providing a broader set of data upon which clinical decisions can be based.
105	HINaz (236)	Web page: Health Information Network of Arizona	Unknown	US	A Health Information Exchange, such as HINaz, is a secure network that takes health care information from multiple health care organizations and sources and provides it to a patient's physician at the point of care when it is needed.
106	HINaz (179)	Web page: Health Information Network of Arizona	Unknown	US	A Health Information Exchange provides a network and universal format that connects hospitals, doctors and other providers. When needed, HIEs allow electronic health records, containing health-related information about a patient, to be securely shared among health care organizations.
107	Hincapie et al (103)	Scientific	2011	US	Health information exchange (HIE) is a potential solution to providing timely and effective clinical information at the point of care
108	HIS (144)	Web page: Indian Health Service for American Indians and Alaska Natives	Unknown	US	The goal of a Health Information Exchange (HIE) is to drive towards efficient exchange of patient data, so that a unified and holistic view of patient data is obtained. This, in turn, will enable physicians to offer better care for patients because providers of care will have a complete picture including all available medical records.
109	HISO (49)	Report: Health Information Exchange Architecture Building Blocks by National Health IT Board	2012	New Zealand	Application-level communication medium with standardised content and transport, across which participants exchange health information.
110	HITECH (199)	HITECH ACT	2009	US	A critical step toward realizing the full potential of electronic health records (EHRs) to improve the coordination, efficiency, and quality of care.
111	Hixny (171)	Webpage: Healthcaer	Unknown	US	HIXNY (“hix-knee”), the Healthcare Information Xchange of New York, is a

S.No.	Author	Source	Year of Publication	Country	Definition
		Information Xchange of New York, an InterSystems partner			not-for-profit collaborative of health plans, hospitals, physician practices, and other healthcare entities working together to enable secure access and electronic exchange of medical information to coordinate quality care, improve patient safety and reduce healthcare costs.
112	HRSA (121)	Web page: US Department of Health and Human Service, Health Resource and Service Administration	Unknown	US	Health information exchange (HIE) is the electronic of health-related information among organizations according to nationally recognized standards. The goal of health information exchange is to facilitate access to and retrieval of clinical data to provide safer, timelier, efficient, effective, equitable, patient-centered care.
113	Hripesak et al (63)	Scientific	2007	US	Health information exchange (HIE) projects—which are often run by regional health information organizations—may be a stepping stone to a fully interoperable health information infrastructure that improves the quality and efficiency of health care in the United States
114	HT (86)	White paper Health Texas Provide Network	Unknown	US	HIE stands for Health Information Exchange and is a term used to describe the sharing of health information through a secure electronic network that allows participating health care systems and providers to electronically share health information about their patients with each other, with other providers who have a treatment relationship with the patient, and for other healthcare operations related activities.
115	(27)	Web page: Solution Provider	Unknown	US	Iatric Systems Clinical Document Exchange allows your healthcare organization to send and receive the pertinent clinical, demographic, and administrative data in real time for a single patient in industry-standard documents, such as those listed in Consolidated Clinical Document Architecture (C-CDA) for Meaningful Use. This document exchange provides caregivers a more complete picture of patient health, leading to more informed treatment decisions and better coordination of care.
116	ICA (290)	Web page: Informatics Corporation of America, provides platforms and services	2012	US	AlliedHIE is a patient-centric, purpose-driven, point-of-care focused national health information exchange company with a mission to include allied health organizations in order to priority connect our most vulnerable and at-risk patients.
117	IHIE (288)	Report: Nationwide Health Information Network (NHIN) Trial Implementations presented to Office of the National Coordinator	2009	US	HIE is a business and as with all businesses, creating a sustainable HIE requires offering services that the market wants at a price the market will bear and doing so in such a way that revenue exceeds expenses. It also means that the services delivered by the HIE must be at a level that healthcare organizations have come to expect from their suppliers.

S.No.	Author	Source	Year of Publication	Country	Definition
		for Health Information Technology US HHS by Indiana Health Information Exchange			
118	IGI Global (180)	Dictionary: IGI Global, publisher	Unknown	Unknown	Health information exchange (HIE) refers to the process of reliable and interoperable electronic health-related information sharing conducted in a manner that protects the confidentiality, privacy, and security of the information. Essential to this process is the capability to employ recognized standards as they are established incrementally, further enabling interoperability, security and confidentiality of the information as well as authorization of those who access the information.
119	ILHIE (203)	Report: Illinois HIE Strategic & Operational Plan by the Illinois Office of Health Information Technology	2010	US	The creation of a State-level health information exchange system will allow, among other benefits, the widespread utilization of electronic health records by health care providers and patients in order to ensure that Illinois health care providers can achieve the Meaningful Use of electronic records, as defined by federal law, and participate fully in the health information technology incentives available from the federal government under the Medicare and Medicaid programs.”
120	Illinois General Assembly (70)	Webpage: Illinois Health Information Exchange and Technology Act	Unknown	US	The Illinois Health Information Exchange ("ILHIE"), to promote and facilitate the sharing of health information among health care providers within Illinois and in other states. ILHIE shall be an entity operated by the Authority to serve as a State-level electronic medical records exchange providing for the transfer of health information, medical records, and other health data in a secure environment for the benefit of patient care, patient safety, reduction of duplicate medical tests, reduction of administrative costs, and any other benefits deemed appropriate by the Authority.
121	Infor (78)	Web page: Infor Company / Solution provider (IBM Enterprise Master Person Index (EMPI))	Unknown	US	Health information exchange (HIE) initiatives that focus on facilitating the exchange of health information electronically among physicians, hospitals, health plans, and patients.
122	Infor Cloverleaf (30)	Web page: : Infor Company / Solution provider / Products	Unknown	US	Infor Cloverleaf Hosted Healthcare Information Exchange is a secure, standards-based infrastructure that integrates clinical data from across disparate systems and manages the wide variety of clinical records, document

S.No.	Author	Source	Year of Publication	Country	Definition
123	iNexx (84)	Web page: Solution provider	Unknown	US	types, and content pervasive in today's healthcare community. Health information exchange (HIE) is the secure, electronic exchange of health information among authorized stakeholders in the healthcare community – such as care providers, patients, and public health agencies – to drive timely, efficient, high-quality, preventive, and patient-centered care. This exchange of healthcare information improves patient care and reduces costs by fostering care collaboration and lowering administrative encumbrances.
124	Inspira (88)	Web page: Inspira Health Network / service provider	Unknown	US	Health information exchange (HIE) allows the sharing of your health information among participating doctors' offices, hospitals, labs, radiology centers, and other health care providers through secure, electronic means. The purpose is to provide participating caregivers the most recent health information available. This health information may include lab test results, radiology reports, medications, hospitalization summaries, allergies, and other clinical information vital to your care. Certain demographic information used to identify the individual such as name, date of birth, address, insurance may also be shared.
125	(225)(225)(225) (225)(225)(225) (225)Inteli Chart (225)	Web page: Inteli Chart / Solution Provider	Unknown	US	Health Information Exchange is much more than just moving data from one spot to another – it's about making the data meaningful, useful and relevant. InteliChart's approach to HIE solutions focus on the acquisition of data and then aggregating the data into a standardized and structured format.
126	InterSystem (47)	Webpage: ehealthnews.eu / Denmark Selects InterSystems HealthShare for Countrywide Health Information Exchange	2012	Denmark	InterSystems HealthShare is a strategic healthcare informatics platform that enables the sharing of patient information via seamless, bi-directional integration, using active analytics to drive decision-making, and unlocking the unstructured data that is found in patient records
127	IOM (56)	Report: Institute of Medicine , Crossing the quality Chasm	2001	US	Health information exchange (HIE), the exchange of electronic health information across health care clinicians and organizations, has the potential to improve health care quality delivered by the US health care system
128	J. (104)	Scientific	2011	US	Health information exchange—the collection of activities and technologies for sharing data generated from separate sources of clinical information—to manage both individual patients and groupings of people with similar clinical

S.No.	Author	Source	Year of Publication	Country	Definition
					conditions
129	Joshi (167)	Scientific	2010	US	Health Information Exchanges (HIE) are rapidly advancing as the next step in improving patient care using technological applications. HIE affect the fundamental patient care system by transforming how medical information is delivered and disseminate
130	Johnson and Gadd (252)	Scientific	2007	US	Health information exchange (HIE) systems are large, multimillion dollar efforts that are implemented despite initial institutional apprehension, with largely unanticipated effects on the clinical workflow, and with a primary goal of establishing a reason to sustain the effort.
131	Jones et al (105)	Scientific	2011	US	Health information exchange (HIE), i.e., electronically exchanging key clinical information such as discharge summaries, procedures, problem lists, medication lists, medication allergies, and diagnostic test results with other external healthcare providers is a core requirement of Stage 1 “meaningful use” for hospitals.
132	Kaelber and Bate (259)	Scientific	2007	US	Better patient safety through enhanced, technology enabled, HIE will directly improve patient safety because it will provide a more complete clinical picture of a patient.
133	Karl (283)	Scientific	2012	US	The term "HIE," acronym for health information exchange, is being used interchangeably to define both the organization that is responsible for managing the exchange of the data (the noun) and the process by which the data can be exchanged (the verb).
134	KC (139)	Web page: Kane County Health Department	Unknown	US	The Health Information Exchange (HIE) will allow local public health departments to be able to evaluate real-time health data on a population level, in order to monitor the health of our community, as well as to assure that we provide the highest quality service to our residents. In addition, we will be better able to respond to health issues in our community.
135	Kern and Kaushal (64)	Scientific	2007	US	HIE involves the sharing of health information electronically across health care settings.
136	Kern et al (125)	Scientific	2009	US	Health information exchange involves the electronic sharing of clinical data, including sharing of clinical data across health care providers caring for the same patient.
137	Key Stone (204)	Web page: Key Stone HIE, Provider	Unknown	US	Keystone Health Information Exchange (KeyHIE) streamlines treatment decisions and care coordination with quick access to both in and out-of-network electronic health records (EHRs)-when and where you need them.
138	Kijisanayotin et al.(229)	Scientific	2007	US	In a health information exchange (HIE) project, linking patients' health records across organizations while maintaining appropriate patients anonymity is

S.No.	Author	Source	Year of Publication	Country	Definition
					essential.
139	KLAS (143)	Web page: Research company	2014	US	Health information exchanges (HIEs) are defined as non-owned hospitals, health systems, ambulatory entities, and/or other third parties that share/exchange patient data and other information.
140	Kongstvedt (77)	Book: Essentials of Managed Health Care, Sixth Edition	2012	US	An entity to facilitate the electronic exchange of health information between physicians, hospitals, laboratories payers and so on, that is sponsored by a state or a federal government.
141	Kralewski et al (237)	Scientific	2012	US	Electronic health information exchange (HIE) among physicians, hospitals, and public health agencies is a fundamental dimension of most proposals for health care reform. It is argued that enabling providers in different settings easy access to a patient's health record would reduce duplication of services and improve treatment decisions.
142	Kuperman (132)	Scientific	2011	US	Health-information exchange, that is, enabling the interoperability of automated health data, can facilitate important improvements in healthcare quality and efficiency.
143	L. Block (299)	Web page: Health Information Technology Knowledge Base	Unknown	US	Health information exchange supports the sharing of health-related information to facilitate coordinated care through the utilization of EHRs. EHRs draw information from many sources through health information exchange. Thus, the process of health information exchange is another piece of the health information technology infrastructure and informatics
144	Lee et al (126)	Scientific	2010	US	The South Carolina Health Information Exchange (SCHIE) provides a state-level information infrastructure for connecting local healthcare providers and other stakeholders. The network enables providers to view clinical data that include medications, diagnoses, and procedures. HIEs provide the infrastructure for information exchange, including the business model, governance structure, operating principles, legal model, and technology model for the exchange of healthcare information among various organizations.
145	Liu (120)	Scientific	2007	US	To provide patient care across the continuum of healthcare delivery sites, care delivery organizations need to consolidate the clinical information from

S.No.	Author	Source	Year of Publication	Country	Definition
					hospitals, clinics, physicians' offices, labs, specialty facilities, and even home healthcare into a single patient record to support the delivery of healthcare services. The ability to exchange and aggregate information from these various systems is essential to improve health, quality, and safety within the US healthcare system.
146	Lloyd-Puryear and Brower (271)	Scientific	2010	US	While several elements are in place to realize a systems approach, the authors think that the key is an integrated, multidirectional health information exchange system that functions locally, regionally and nationally, and enables information exchange between private and public health sectors.
147	LMO (89)	Web page: Liquid Medical Office, Inc. Solution Provider	Unknown	US	Health information exchange (HIE) is a secure electronic exchange of health information among authorized healthcare networks to improve safety, efficiency, and continuity of care. Data exchanged through the HIE is shared safely and securely, meeting or exceeding HIPAA standards.
148	Lobach et al (65)	Scientific	2007	US	Information technology, and in particular a health information exchange (HIE), has the capacity to enhance the management of the health of populations by promoting the sharing of health information across independent healthcare organizations. The information available through HIEs can be used by clinical decision support (CDS) systems to identify sentinel health events and patient-specific care needs, and then to promote proactive interventions.
149	Loonsk (195)	Web page: CGI, Initiative for Collaborative Government	2010	US	HIE" is used to describe: hospitals sharing lab reports and discharge summaries with affiliated providers; multi-stakeholder Regional or State Health Information Organizations (RHIOs, HIEs, HIOs); the exchange of information among the products of a single EMR vendor; the secure emailing of documents; and, perhaps most simply and broadly, the ability of any piece of software to exchange information. HIE can include information being browsed, "pulled" and/or "pushed," and information that is fully coded with nationally recognized vocabularies or information that is in barely processable document formats.
150	Lori (221)	White paper: What is HIE? A Federal and State Perspective by Object Health, LLC. Women Consulting Group	Unknown	US	The movement of data between health information systems for the purposes of: Patient communication Provider Communication State Communication Health information exchange describes an action: Provider orders a lab test

S.No.	Author	Source	Year of Publication	Country	Definition
					Lab result is delivered to Provider Provider tells the patient the results.
151	Louisiana (182)	Webpage: Louisiana Health Information Exchange	Unknown	US	Known as LaHIE, the exchange allows authorized providers and organizations to electronically access and share health-related information through a secure and confidential network for the purpose of improving patient safety, quality of care and health outcomes.
152	Luo (193)	Scientific	2006	US	Exchange of information is one of the key elements to making EMRs beneficial to patients across the healthcare spectrum, whether at the physician's office, hospital, or pharmacy.
153	Mäenpää et al. (52)	Scientific	2011	Finland / Sweden	The implementation of a technology such as health information exchange (HIE) through an (regional health information systems) RHIS should improve the mobilization of health care information electronically across organizations within a region, by coordinating care and bringing together local stakeholders.
154	Maine (157)	Web page: Maine State HIE	Unknown	US	CMS defines HIE as the secure and interoperable sharing of health information in a manner that protects the confidentiality, privacy, and security of an individual's information.
155	marchcarson100 (282)	Blog: mandmhitech	2011	Unknown	HIE is a group of entities with the capability to move info digitally using nationwide standards. HIE is a Process Health Info Exchange (HIE) refers back to the strategy of enabling the dependable sharing of digital patient care-associated data amongst health care associated entities and networks. This sharing is done in a way that protects the confidentiality, privacy and safety of the information. Central to this concept is the usage of nationally recognized standards currently in place and future ones as they are published. HIEs can even provide key information to people to promote improved health and wellness, and can be used to assist research, public well-being, emergency response, and high quality improvement. Additionally, an HIE allows the sharing of health-related data amongst healthcare organizations and with individuals on a neighborhood, regional, and nationwide basis.
156	Marchibroda (246)	Book: Health Literacy, eHealth, and Communication	2009	US	Health information exchange is another major component of eHealth. This refers to the electronic exchange of data across organizations and disparate information systems, including data from laboratories, pharmacies, plans, physicians, or hospitals

S.No.	Author	Source	Year of Publication	Country	Definition
157	Matthews et al. (98)	White Paper: Indiana and Ohio Health Information Exchanges Connect for Nation's First Live, Multi-Region Clinical Information Exchange	2009	US	Live exchange will allow secure electronic exchange of health information, reduce duplication, improve efficiency, improve patient care and further the nation's goal to interconnect healthcare
158	McIlwain and Lassetter (194)	Scientific	2009	US	A well-designed HIE should enable bi-directional integration between practice and hospital EMRs, as well as interoperability with other physicians' EMRs or outside systems, such as reference labs. Patients should also be able to integrate their medical histories with a personal health record (PHR), such as Google Health or Microsoft's HealthVault.
159	(149)	Webpage: Computer World, News. Verizon creates medical information exchange cloud	2010	US	Verizon Health Information Exchange, consolidates clinical patient data from various providers and translates it into a standardized format that can then be accessed via a secure Web portal.
160	Merrill (31)	Web page: Molly Merrill is the Associate Editor of Healthcare IT News. She covers physician practice IT issues and national breaking news.	2009	US	The Georgia Cancer Coalition, an independent, not-for-profit organization based in Atlanta, will use a state-wide healthcare information exchange to share evidence-based medicine with community cancer care centers. The exchange will serve as a trusted third party in the state to acquire, analyse and report de-identified patient data around quality measures from providers and hospitals that deliver cancer care.
161	Merrill et al (148)	Scientific	2013	US	Electronic HIE for public health reporting (HIE for PH) is a powerful strategy for shaping both short and long term policies to promote the health of populations through: rapid and efficient identification, monitoring, investigation, and treatment of communicable and emerging diseases; early identification of food borne outbreaks and environmental exposures; identification of health risk factors; and planning and evaluation of public health services.

S.No.	Author	Source	Year of Publication	Country	Definition
162	Mental Health (58)	Mental Health Information and Primary Care Integration Act of 2011	2011	US	Health information exchange: an electronic system that receives maintains and facilitates the transfer of protected health and mental health information by and between mental health and healthcare providers.
163	MHIE (300)	Web page: Memorial Hermann Information Exchange for authorized exchange members	Unknown	US	MHIE's (Memorial Hermann Information Exchange) suite of solutions facilitates access to important clinical information to provide safer, efficient and equitable patient-centered care.
164	Michigan (129)	Report: 2007-2008 Report to the Michigan Legislature by the Michigan Health Information Technology Commission	2008	US	Health Information Exchange is a way to electronically move personal health and medical information securely between various health care organizations and providers under current medical privacy and confidentiality standard procedures. The goal of HIE is to facilitate delivery and retrieval of clinical data to provide safe, timely, efficient, effective, and equitable patient-centered care. In short, the goal of HIE is to ensure that providers have the right information about their patient at the right time to provide the best possible care.
165	Minnesota (228)	Web page: Minnesota Department of Health	Unknown	US	Health information exchange, or HIE, in Minnesota means the electronic transmission of health related information between organizations according to nationally recognized standards. This means each time information is sent electronically to another provider it is done in a uniformly accepted way that meets specific standards to ensure protection of the data and privacy of the patient. It also means the information will be received in a way that is usable for the recipient.
166	Minnesota health (301)	Web page: A Practical Guide to Understanding HIE, Assessing Your Readiness and Selecting HIE Options in Minnesota by Minnesota Department of Health	Unknown	US	HIE refers to the secure electronic sending and receiving of clinical health information in ways that the information can be understood by both the sender and the receiver of the information.
167	Mobile MD (196)	Web page: Siemens HIE Solution	2011	US	MobileMD® is a vendor-neutral, fully outsourced health information exchange (HIE) for health systems, hospitals, physicians, labs and ancillary healthcare providers. It offers secure messaging, analytic solutions, an EMR to physician practices, and connects healthcare providers and patients through secure clinical and patient portals. Together, the HIE enriches care teams with

S.No.	Author	Source	Year of Publication	Country	Definition
168	Mobile MD (198)	Web page: Siemens HIE Solution	Unknown	US	information as patients move through the healthcare system. MobileMD [®] , a Siemens solution, is a four-dimensional health information exchange – care, service, economics, and technology – providing physicians with near real-time, secure, clinical and administrative information regardless of location, affiliation, EMR technology, or vendor.
169	Moore (106)	Blog / Report	2011	US	A Health Information Exchange (HIE) is a technology network infrastructure whose primary purpose is to insure the secure, digital exchange of clinical information among all stakeholders that are engaged in the care of a patient to promote collaborative care models that improve the quality and value of care provided.
170	Moore et al. (302)	Scientific	2012	US	A health information exchange (HIE) can provide automatic notifications to its members by building services on top of their existing infrastructure.
171	Morgan Hunter (114)	Blog: Company, Morgan Hunter Healthcare Inc.	Unknown	Unknown	HIE refers to any ongoing exchange of electronic clinical information between organizations such as hospitals, physician offices, clinics, clinical research groups, public health entities and quality assurance groups. It also includes the ongoing exchange between care provider organizations and consumers' personal health records (PHRs).
172	Morrissey (201)	Magazine	2013	US	Health information exchange — that set of activities concerned with getting clinical documentation from the places where it was created to other places that could really use the information — lacked some basic components: a critical mass of computer systems to create discrete data; standards allowing data from one electronic health record to be taken in by another; and routine methods to transmit the data anywhere it needed to go.
173	Mosbys (278)	Mosbys Medical Dictionary	2009	US	A nursing intervention from the Nursing Interventions Classification (NIC) defined as providing patient care information to other health professionals
174	Mount Sinai (303)	Web page: Mount Sinai HIE, Mount Sinai Hospital	Unknown	US	Health Information Exchange is the sharing of health information electronically between providers. This exchange can be done directly between two providers that care for the same patient or can be enabled through a technology that provides the electronic information to a provider. Information can only be shared between providers if a relationship exists with a patient or the patient explicitly gives their approval to access their information.
175	MSV (82)	We page: Medical Society of Virginia	Unknown	US	Virginia's health information exchange (HIE) aims to help connect providers and patients. A HIE provides authorized users with access to patients' health-related information that is typically stored in multiple organizations, while maintaining the integrity of the information being exchanged. It may be a community-based, regional, statewide or larger exchange that facilitates the

S.No.	Author	Source	Year of Publication	Country	Definition
					electronic exchange of information between providers. These resources will help you understand the state's framework for health information exchange and how it will facilitate improvements in care coordination and information sharing.
176	MTBC (130)	White Paper: What is Health Information Exchange (HIE) by MTBC, healthcare IT company	Unknown	US	Health Information Exchanges (HIE) are organizations that synergize and effectively streamline health information records. Many state governments provide funding for HIE implementation with the goal of facilitating access to and retrieval of clinical data to provide more timely, focused, and equitable patient-centered care.
177	Munoz et al. (219)	Scientific	2013	US	HIEs are electronic networks into which health providers can connect to have access to all medical records for an individual within a particular community
178	Murphy a (232)	Web page: ehrintelligence.com for latest technology news and white papers / Article	2012	US	Exchange of electronic information between providers and across platforms that is secure and safeguards patient privacy. HIE is closely aligned with interoperability so that information can flow back and forth between doctors, patients, and health networks.
179	Murphy b (287)	Web page: ehrintelligence.com for latest technology news and white papers / Article	2012	US	An HIE bridges the knowledge gap between providers, allowing them to trace the treatment of patients by various providers and act upon this information in a meaningful way. But on a higher level, an HIE could prove invaluable for an entire population.
180	Myers et al.(66)	Scientific	2012	US	Health information exchanges (HIE) that facilitate the exchange of health information across clinical and non-clinical settings can support teams of providers – physicians, health educators, social workers, and pharmacists – caring for patients with HIV (305) by expanding access to patient information.
181	NAHIT (172)	Report to the Office of the National Coordinator for Health Information Technology on defining key health information technology terms	2008	US	Health information exchange is another form of HIT, which enables electronic movement of health-related information among organizations.
182	NAHP (209)	Report: EHR by National Association for Health Professionals	2011	US	Health information exchange (HIE) has emerged as a core capability for hospitals and physicians to achieve "meaningful use" and receive stimulus funding. Healthcare vendors are pushing HIE as a way to allow EHR systems to pull disparate data and function on a more interoperable level.
183	Nakamura et al	Scientific	2010	US	Hospitals' involvement in HIE, defined as active exchange of electronic data

S.No.	Author	Source	Year of Publication	Country	Definition
	(305)				
184	NaviNet (291)	Blog: The Medical Quak, post: NaviNet HealthCare Communication Network – Transactional Portal Information Exchange	Unknown	Unknown	NaviNet helps doctors' offices instantly access patients' insurance information, such as their benefits eligibility and claims status, over the Web.
185	NCHICA (208)	Report: Prepared by the NCHICA Consumer Advisory Council on Health Information (CACHI) for The North Carolina Health Information Technology Strategic Planning Task Force	2009	US	The standardized electronic exchange of health records (typically EHRs) between healthcare providers to enable continuity of care.
186	NC HIE (152)	Web page: North Carolina Health Information Exchange	Unknown	US	NC HIE operates North Carolina's statewide health information exchange, a secure, standardized electronic system in which providers can share important patient health information. The use of this system promotes the access, exchange, and analysis of health information. NC HIE enables participating organizations to: Save time and reduce paperwork Facilitate more informed treatment decision-making Leads to improved care coordination, higher quality of care, and better health outcomes.
187	NDHIN (80)	Web page: North Dakota Health Information Network	Unknown	US	Health information exchange that utilizes information infrastructure and systems in a secure and cost-effective manner to facilitate the collection, storage, and transmission of health information.
188	NRC (118)	Book: Networking Health: Prescriptions for the Internet	2000	US	Health information exchange (HIE) makes previously inaccessible data available, resulting in the availability of more complete clinical information, which could improve the quality of care.

S.No.	Author	Source	Year of Publication	Country	Definition
189	NV HIE (91)	Web page: Nevada HIE	Unknown	US	The chief purpose of the NV-HIE is to provide oversight and governance of the statewide system for the authorized and secure electronic exchange of health information and to establish and maintain a sustainable governance and business structure which achieves broad-based public-private stakeholder collaboration with transparency and accountability while protecting the public interest
190	OCI (174)	Report: Building a Health Information Exchange for the State of Missouri by Object Computing, Inc.	2009	US	A Health Information Exchange (HIE) enables sharing of electronic health-related information among health care providers, patients, and public health agencies.
191	(87)(87)(87)(87) (87)(87)(86)One Partner HIE (87)	Web page: One Partner HIE	Unknown	US	A health information exchange (HIE) is the electronic mobilization of health information across healthcare organizations within a region, across the nation, and globally. Basically, it's the "one-to-many" or the "many-to-many" delivery of health information to improve care, making care more patient-centric. The foremost goal of an HIE is to make possible the access and retrieval of clinical data so care may be delivered in a safer and more timely manner. Fostering improved patient care by encouraging involvement of multiple clinicians from across the patient care spectrum, continuity of care is greatly improved.
192	Onyile et al. (24)	Scientific	2011	US	The New York Clinical Information Exchange (NYCLIX), a functioning health information exchange, is used by emergency department (ED) personnel to obtain prior health data.
193	Onyile et al.(25)	Scientific	2013	US	The New York Clinical Information Exchange (NYCLIX) was a Manhattan-based RHIO, which built an operational, secure HIE available to authorized hospitals and other healthcare providers in the NYC metropolitan area. NYCLIX was a collaboration among ambulatory physician groups, long-term care facilities, a Medicaid managed care plan, the nation's largest home healthcare provider and academic medical centers.
194	Open Source (231)	Web page: Hartford Hospital: Open Source HIE. Open Source Community for Healthcare.		US	Health Information Exchange (HIE) that will link the acute care hospitals with the ambulatory and tertiary care facilities along with the labs and diagnostic centres in the region.

S.No.	Author	Source	Year of Publication	Country	Definition
195	OPTUM (113)	Web page: Company / Solution Provider	Unknown	US	HIE provides the capability to electronically move clinical information among disparate health care information systems while maintaining the meaning of the information being exchanged. An HIE is a foundational piece of the Accountable Care Organizations (ACO) because it provides a way for EMRs to exchange information across different types of medical records.
196	Oracle (140)	White paper Oracle Health Information Exchange: Secure, Seamless Data Sharing	2012	US	Health information exchange (HIE)—the seamless, secure, electronic sharing of health data across networks.
197	Orion HIE (97)	Web page: Orion Health, Solution Provider	Unknown	US	Orion Health™ Health Information Exchange (HIE) is a powerful health information backbone that enables organizations and clinical communities to exchange medical information and share complete patient records. Whether a hospital or health system, a public or regional HIE, Orion Health gets your organization connected. Orion Health HIE enables the exchange of any clinical information between organizations, ensuring that all clinical staff have access to relevant, up-to-date and accurate patient information regardless of where care is provided or the clinician is located.
198	Overhage et al (2)	Scientific	2005	US	Health information exchange, defined as the electronic sharing of health information across health care organizations within a region, community, or hospital system, is advocated as essential to improving health care quality and reducing costs
199	Overhage et al (265)	Scientific	2007	US	The country has identified health information exchange (HIE) as an essential strategy to address our crisis of cost, quality, and safety in health care. (HIE) networks that are, in turn, a collection of interconnected, interoperable health information systems (HIS).
200	Ozkaynak and Brennan (306)	Scientific	2013	US	Health information exchange (HIE) allows clinicians to access patient level health care information.
201	PAeHealth (85)	Electronic Article: What is the Difference between HIX and HIE? By PA eHealth Partnership Authority	Unknown	US	HIE stands for health information exchange. HIE plays an important role in giving the healthcare system a 21st century upgrade. It gives providers—doctors, nurses, hospitals, pharmacies, laboratories and others—the ability to exchange health information electronically with other providers in a secure environment
202	Palmetto (197)	Web page: Palmetto Health: Healthcare, non-profit healthcare resource	Unknown	US	A Health Information Exchange (HIE) is a convenient electronic service that allows healthcare providers at multiple sites to have access to a patient's EMR. Palmetto Health recently launched Provider HIE, which includes Palmetto Health hospitals and physician practices. There is no cost to you to

S.No.	Author	Source	Year of Publication	Country	Definition
203	Payne et al. (22)	Scientific	2011	UK	allow your EMR to be accessible through the HIE. Clinical information exchange in the UK was accomplished by establishing a foundation of policy, infrastructure, and systems of care, by creating and acquiring clinical computing applications, and with strong use of financial and clinical incentives.
204	PCMAG (72)	Web page: pcmag.com for tech news, buying guides, reviews etc.	Unknown	US	Health Information Exchange, a service that enables exchange of healthcare information between hospitals and regions. The information is not only used to provide medical data for people who move to a different geographic area, but also to provide statistics for public health in general. There are many regional health information organizations (RHIOs) throughout the U.S. that are involved in health information exchange (HIE), and the terms RHIO and HIE are used synonymously.
205	PDN (107)	Web page: Professional Dynamics Network Inc.	2011/12	US	HIE (Health Information Exchange) refers to the technological network infrastructure, that has the chief purpose of assuring accurate medical information exchange. This patient data and electronic health records (EHR), which is digital information and secure, is clinical information used in between medical organizations who are responsible for providing healthcare to the patients. A Health Information Exchange provides a technology platform that promotes collaborative care models that are crucial to improve the value and quality of the healthcare provided.
206	PDN (115)	Web page: Professional Development Network, Inc.	Unknown	US	Health information exchange system is responsible for mobilizing the healthcare information electronically throughout the associated organizations that are bordered by community, hospital system and region. Health information exchange can endow us the ability to transfer clinical information electronically in between the network of health care (115) information systems and at the same time maintaining and securing the true meaning of the information being exchanged. It is the job of health information exchange system to provide the access to and retrieval of the medical data in order to facilitate effective, patient-centered, timely, safe, secured and equitable health care. The health information exchange system is also fruitful in terms of providing assistance to the Public Health authorities in the analyses of the countrywide population health.
207	Pennsylvania (177)	Report: Pennsylvania eHealth Collaborative Strategic Plan for Health Information Exchange	2012	US	Health Information Exchanges (HIEs) are entities often built on a series of often bilateral legal agreements between different, often proprietary information systems to be able to share certain kinds of data. The electronic movement of health-related information among unaffiliated organizations

S.No.	Author	Source	Year of Publication	Country	Definition
		2012			according to nationally recognized standards. HIE provides the opportunity to improve quality and safety of care, improve efficiency, reduce costs and make care more convenient for
208	Princeton (96)	Web page: Princeton Healthcare System	Unknown	US	Princeton HealthCare System's Health Information Exchange (HIE) called Princeton HealthConnect® uses health care technology allows hospitals, doctors and other health care providers to electronically share health information with each other in a secure, timely manner. This health information could include reports about your illnesses, injuries, allergies, medicines and test results.
209	Privacy Rights (220)	Web page: California Medical Privacy Fact Sheet C2: How Is Your Medical Information Used and Disclosed - With and Without Privacy Rights Clearing House	2012	US	HIE will make your records electronically accessible to all permissible health care personnel, wherever those records may be.
210	Prism (243)	Web page: Prism Health Services, Consulting Company	Unknown	US	An HIE enables the exchange of health-related data among health providers, public health agencies, payers, and patients. Again, the core purpose is for improving the quality and efficiency of healthcare delivery and, ultimately, the improvement of population health. Building trust and consensus among stakeholders is key to ensuring the success of an HIE.
211	RCHN (68)	Web page: RCHN Community Health Foundation (RCHN CHF) is a not-for-profit operating foundation	Unknown	US	Sometimes the term HIE is used as part of the name of a Regional Health Information Organization, or RHIO, defined in the same report as, "a health information organization that brings together health care stakeholders within a defined geographic area and governs health information exchange among them for the purpose of improving health care in that community." Here "HIE" mean the process of sharing information and "RHIO" mean the organization that facilitates the sharing.
212	Rebryna (45)	Scientific	2009	Canada	Regional health information organizations (RHIOs) or health information exchanges (HIEs) vary in definition, but the overall concept rests on the exchange of health information across organizations.
213	Recogniti (169)	Web page: Recogniti, Solution provider	Unknown	US	Health Information Exchange allows health care professionals and patients to appropriately access and securely shares a patient's vital medical information electronically. There are many health care delivery scenarios driving the technology behind the different forms of health information exchange

S.No.	Author	Source	Year of Publication	Country	Definition
					available today. Health Information Exchange (HIE) is one of the most common forms of utilizing an EHR solution.
214	Reeder (210)	Web page / Post: Vendor, EHRDoctors	2011-2012	US	When asked for a definition of HIE, the answers we get back range from: paperless, email, provider portals, and electronic summary of care records.
215	Reeder et al (127)	Scientific	2012	US	A Health Information Exchange (HIE) provides a secure, interoperable infrastructure for electronically moving clinical data between heterogeneous health information systems and its stakeholders, including public health.
216	Regan (20)	Scientific	1991	Australia	Electronic Data Interchange (EDI) promises to speed the transfer of medical data, insurance information and payments.
217	Revere and Stevens (256)	Scientific	2010	US	HIEs have developed real-time, nationwide public health event-monitoring capability to assist with and improve early event detection, public health situational awareness, outbreak management, and countermeasure and response administration.
218	Rhode Island (90)	Web page: State of Rhode Island, Department of Health	Unknown	US	Rhode Island's health information exchange system is an electronic network that gives medical professionals access to their patient's health information. It will help healthcare providers give their patients the best possible care by giving healthcare providers access to their patient's health information, including information that comes from other providers. Health care consumers can choose to participate in current care and can control who can access their health information.
219	RIQI (156)	Web page: Current Care Rhode Island HIE, Rhode Island Quality Institute	Unknown	US	CurrentCare, Rhode Island's the Statewide Health Information Exchange (HIE), is a secure electronic system which will allow doctors and other care givers immediate access to a patient's up-to-date health information in order to provide the best possible and most comprehensive care.
220	Ross et al.(214)	Scientific	2010	US	COMMUNITY-HIE: Currently engaged in community-wide HIE, defined as a system that consolidates and provides more than one category of information (e.g., laboratory test results, radiographic results, clinical notes) from more than one independent organization. COMMUNITY-HIE practices could use either paper or electronic medical records.
221	Rouztan (170)	Web page / Blog: Central Illinois Health Information Exchange Blog	2013	US	What an HIE does is allow a healthcare provider to log into a secured website and pull up all of the medical information about you from all of your medical caregivers (as long as they are participating in sharing data with the HIE) in one place. This is similar to searching a site like Expedia for travel options. It goes out and pulls all the information into one screen for you.
222	Rowley (136)	Post: Healthcare Technology Consultant	2013	US	Health Information Exchanges (HIEs) are defined in HITECH, and are envisioned as hubs where different systems can exchange health data

S.No.	Author	Source	Year of Publication	Country	Definition
					(assuming they have cracked the patient-identity nut) and break down the silos of EHR data.
223	RSA Index (83)	Web page: New Hampshire Revised Statutes Annotated (RSA) Index	1989	US	“Health information exchange” means an entity established for the primary purpose of enabling and overseeing the exchange of protected health information for clinical decision-making purposes. The entity may operate on a regional, statewide, or multi-state basis. The entity may be developed by multiple stakeholders, including, but not limited to, the department of health and human services, a non-profit entity, or a for-profit entity.
224	SafeNet (33)	Security Guide: What You Need to Know About Securing Healthcare Information Exchanges by , SafeNet, a global leader in information security	2010	US	Healthcare Information Exchanges (HIE) provide the capability to electronically move clinical information among different healthcare organization like hospitals, physician offices, pharmacies, and health insurance companies. HIEs are quickly emerging since they facilitate access to clinical data allowing healthcare professionals a more efficient and simple way to access patient data
225	San Diego (32)	Web page: San Diego Regional HIE	Unknown	US	The San Diego Regional Healthcare Information Exchange (San Diego Beacon) is a collaborative of local hospital systems, community clinics, emergency medical services and public health organizations whose goal is to deliver the highest quality health care to all San Diegans.
226	SCA (112)	White Paper: Healthcare Identity Management: The Foundation for a Secure and Trusted National Health Information Network. Smart Card Alliance Position Paper for Government Policy Makers and Healthcare Stakeholders	2009	US	An HIE provides the capability to securely and confidentially enable electronic transfer of clinical information among separate healthcare information systems, while maintaining the meaning of the information being exchanged.
227	Schulte (145)	Book: Healthcare Delivery in the U.S.A.: An Introduction	2012	US	HIE refers to the technology and process infrastructure that supports the sharing of clinical and other patient data within a geographic region and among the organizationally unrelated providers of care in that region.
228	SEMHE (92)	Web page: Southeast Michigan Health Information Exchange	Unknown	US	The Southeast Michigan Health Information Exchange (SEMHE) is a multi-stakeholder initiative dedicated to delivering the promise of integrated health information exchange throughout Southeast Michigan. When successfully

S.No.	Author	Source	Year of Publication	Country	Definition
		(SEMHIE)			deployed, SEMHIE will: Enhance patient care, quality and safety Increase effectiveness and efficiency of healthcare delivery Reduce healthcare costs.
229	Shade et al (223)	Scientific	2012	US	Health information exchange (HIE) is the process of electronic multi-directional transfer of identifiable, patient-level information between different organizations.
230	Shapiro et al.(239)	Scientific	2007	US	Health information exchange (HIE) is a potentially powerful technology that can improve the quality of care delivered in emergency departments.
231	Shapiro (128)	Scientific	2007	US	They (HIE) aim to bring previously unavailable clinical data from patients' disparate health records, which may be spread over multiple provider and payer networks, to the point of care where clinicians and their patients need it most.
232	Shapiro et al (202)	Scientific	2010	US	Health information exchange, which enables the flow of electronic data among disparate providers and electronic health records
233	Shapiro et al (267)	Scientific	2013	US	The NYCLIX HIE provided the technical, organizational, and policy infrastructure to support electronic data exchange across member sites.
234	Sicotte and Paré (248)	Scientific	2010	Canada	Interest in health information exchange (HIE), defined as the use of information technology to support the electronic transfer of clinical information across health care organizations, and continues to grow among those pursuing greater patient safety and health care accessibility and efficiency.
235	Sitig and Joe (133)	Scientific	2010	US	The local and regional Health Information Exchanges (HIEs) should provide the technical, financial, privacy oversight and governance of all aspects of an electronic portal through which individual patients' health data can be transferred between and among authorized users, in accordance with agreed-upon information exchange policies and standards, and subject to strict privacy and security protections. Users of an HIE can include patients, providers, public health officials, payers, and researchers.
236	Smith (217)	Web page / Post	2012	US	Health Information Exchange (HIE) is both a verb and a noun; it is the transmission of clinical or claims information from one party to another, and may occur without the presence of a data warehouse or centralized registry, typically known as a HIE.
237	Steward et al (249)	Scientific	2012	US	Health information exchanges (HIEs) require a synthesis of goals, protocols, data formats, and infrastructure within and across organizations.
238	STHL (147)	Web page: Southern Tier	Unknown	US	A health information exchange (HIE) is technology that allows healthcare

S.No.	Author	Source	Year of Publication	Country	Definition
		HealthLink (STHL), a non-profit RHIO			information to pass electronically across organizations within a particular region or community. Clear and strict state and federal guidelines govern how the information can be exchanged, viewed, and used. The goal of the HIE is to make the information available when and where it is needed.
239	Stoten (207)	Scientific	2009	US	The Indiana Health Information Exchange (IHIE), known throughout the United States as being in the forefront of the Regional Health Information Organizations (RHIO) initiative, allows physicians to access information directly from their website or through a hospital portal. IHIE provides results such as dictation, lab, and radiology results and information is delivered to the physicians through direct connections with an EHR
240	SuccessEHS (186)	Web page: SuccessEHS Solution Provider	Unknown	US	HIE is both a verb and a noun. HIE as a noun: A health information exchange (HIE) refers to an exchange network or an organization that operates a network that connects the electronic health information systems of different health care providers. HIEs enable those providers to share clinical and demographic data of patients they have in common. For instance, a primary care physician may share a patient's data with that patient's cardiologist. HIE as a verb: Health information exchange is the actual transmission of health information. There are multiple types of HIE, including Direct, XDS, Exchange and custom HL7.
241	Suenaga (183)	Web page: About the State HIE, Hawaii Health Information Exchange	2012	US	The State Health Information Exchange is a secure electronic network that enables Hawaii health care providers – such as physicians, pharmacies, labs and other medical providers – to exchange select patient medical information.
242	Tang and Lee (261)	Scientific	2009	US	Health information exchange (HIE), a process that has been referred to as 'tethering' or 'interconnecting'
243	Texas HIE (154)	Web page: Texas HIE		US	Electronic health information exchange, or HIE, is the secure electronic movement of health information among treating physicians and other healthcare providers and related organizations according to national and state laws and nationally recognized standards.
244	THHSC (93)	Web page: Texas Health and Human Service Commission	Unknown	US	The creation of a statewide health information exchange will allow health information to be securely exchanged between providers within Texas. This will increase the coordination and quality of care while improving efficiency in the health care system and increasing consumer empowerment and control.
245	Thomas (76)	Web page / Post: Open HIE Wiki	2013	Unknown	A Health Information Exchange (HIE) makes the sharing of health data across information systems possible. Like a universal translator, an HIE normalizes

S.No.	Author	Source	Year of Publication	Country	Definition
					data and secures the transmission of health information throughout databases, between facilities, and across regions or countries
246	Tripathi et al (307)	Scientific	2009	US	Health information technology (IT) and health information exchange (HIE) are increasingly viewed as key steps in improving the quality, safety, and efficiency problems that plague U.S. health care delivery
247	Unertl et al.(134)	Scientific	2012	US	Health information exchanges (HIE) support automated sharing of health data across organizational boundaries.
248	Utah (28)	Report: Utah Statewide Clinical Health Information Exchange 2011, Annual Legislative Report by The Utah Legislative Health and Human Services Interim Committee	2011	US	The goal of the Utah cHIE initiative is to create a secure electronic clinical health information exchange (cHIE) network whereby a Utah health care provider can, with patient permission, access basic medical information about their patients no matter where the patient receives care in Utah. Health care providers are not required to participate but may choose the option to participate in the cHIE.
249	Utah State (29)	Report: Utah Clinical Health Information Exchange, Government to Business, State of Utah	2011	US	The Clinical Health Information Exchange (cHIE) provides physicians a way to share and view patient information in a secure electronic manner. This information is accessible, with patient consent, to authorized users while maintaining the highest standards of patient privacy. The goal of the cHIE is to improve the quality of care you receive by increasing efficiency and maintaining patient safety. This is accomplished by enabling healthcare professionals to be better informed, and by reducing time and expense associated with missing information and ordering of duplicate tests.
250	UW Health (206)	White paper: The University of Wisconsin-Madison, school of medicine and public health	Unknown	US	Electronic health information exchange is a service for patients who may receive care at more than one health care organization using electronic health record software.
251	Vaidya et al. (241)	Scientific	2012	US	HIE, which enables the exchange of clinical information among multiple stakeholders, offers hope for improving the quality of care delivered by registered nurses (RN)s working in home healthcare.
252	Vanguard Systems	Webpage: Vanguard	Unknown	US	Convergent's OmniMD health information exchange (HIE) is meant to

S.No.	Author	Source	Year of Publication	Country	Definition
	(190)	Systems, Solution Provider			transmit healthcare-related data among facilities, health information organizations (HIO) and government agencies according to national standards
253	Vest (240)	Scientific	2009	US	Health information exchange (HIE) makes previously inaccessible data available to clinicians, resulting in more complete information.
254	Vest and Jasperson (281)	Scientific	2012	US	Health information exchange (HIE) is an avenue to improving patient care and an important priority under the Meaningful Use requirements.
255	Vest (224)	Scientific	2012	US	Health information exchange (HIE), the process of electronically moving patient-level information between different organizations, is viewed as a solution to the fragmentation of data in health care.
256	Vest et al. (258)	Scientific	2013	US	Health information exchange (HIE) is a promising approach to improving the cost and quality of healthcare
257	Virginia (308)	Web page: ConnectVirginia HIE, Inc. is the Statewide Health Information Exchange (HIE) for the Commonwealth of Virginia	Unknown	US	ConnectVirginia provides a secure, confidential electronic system to support the exchange of patient medical records among participating health care providers in Virginia and beyond.
258	VITL (187)	Web page: VITL Solution Provider	Unknown	US	A health information exchange (HIE) is a secure computer network that connects the electronic health information systems of different health care providers, enabling those providers to share clinical and demographic data of patients they have in common.
259	Voigt and Torzewski (109)	Scientific	2011	US	Health information exchange (HIE) has long been touted as a silver bullet, streamlining patient transfers, reducing duplication, enlightening population health, and generally improving health outcomes. It promises to connect clinicians, empower patients, feed data repositories, and trigger decision support alerts from a community-wide set of patient records, among other things. Critical to these solutions is an HIE network that is broadly adopted within a patient community and a rich flow of discrete clinical information.
260	Vreeman (135)	Scientific	2007	US	A comprehensive health information exchange must coalesce all of the various sources that produce health data in order to provide clinicians with information when and where they need it.
261	Walker et al.(233)	Scientific	2005	US	Many providers and policy makers now recognize that the sharing of data among hospitals, doctors, and other health care organizations in a given city, state, or region often referred to as health information exchange (HIE) can make health care safer, more efficient, and more effective.

S.No.	Author	Source	Year of Publication	Country	Definition
262	Warholak et al (226)	Scientific	2011	US	HIE was defined as a computer-based system that mobilizes health care information electronically across organizations within a region.
263	Whittenburg (242)	Scientific	2008	US	Health information exchange using an online metadata registry allows nurses, health professionals, hospital administrators, and diverse information systems to make significant strides towards improving health outcomes and human quality of care
264	Wikipedia (110)	Webpage: article on HIE	Unknown	Unknown	Health information exchange (HIE) is the mobilization of healthcare information electronically across organizations within a region, community or hospital system. HIE provides the capability to electronically move clinical information among disparate health care information systems while maintaining the meaning of the information being exchanged. The goal of HIE is to facilitate access to and retrieval of clinical data to provide safer and more timely, efficient, effective, and equitable patient-centered care. HIE is also useful to public health authorities to assist in analyses of the health of the population.
265	Williams et al. (234)	Scientific	2012	US	The goal of health information exchange is for information to follow patients, wherever and whenever they seek care, in a private and secure manner so that teams of doctors, nurses, and care managers can provide coordinated, effective, and efficient care.
266	WPF (163)	Web page: HIE in California. World Privacy Forum, public interest research group.	Unknown	US	A Health Information Exchange, or HIE, is technology that enables the electronic movement of health-related information among health care providers and others. HIEs are an increasingly popular way for hospitals, pharmacies, labs, and emergency room physicians to share patient information. Some HIEs just share information within one hospital network, some share information across many hospitals or physicians in a region, and some HIEs share information across the state.
267	Wright et al (1)	Scientific	2010	US	HIE is the ability for clinicians to share a core set of clinical patient data across practices and entities
268	Xerox HIE (309)	Web page: Xerox healthcare IT solution	Unknown	US	Focusing on preventive and outcomes-based medicine, the HIE solution makes comprehensive patient health information available, even at the point of care. This exchange of information helps reduce medical errors and redundant medical procedures as well as improves patient safety and well-being.

Appendix B: Recurrent topics of HIE

Author	Data and Information	Information Transfer	Stakeholders	Potential Benefits	Technology	Location	Business	Standards	Public Health	Sectoral or Regional Scope	Focus / Context
1 st PC (178)	*	*		*							* process
4Med (188)	*	*	*			*		*			
Abhyankar et al (215)	*	*	*	*	*						
Accenx (165)	*	*	*	*					*	*	* Service
Adler-Milstein et al (122)	*	*	*						*		
Adler-Milstein et al (54)	*	*	*	*							
Adler-Milstein and Jha (123)	*	*	*								
Adler-Milstein et al (55)	*	*	*			*					* Process
AeHN (16)	*	*			*						
Afzal (71)	*	*		*	*	*					

Bostick et al. (175)	*	*		*						*	*							
Bouhaddou et al (100)	*	*		*			*					*						
Boyle (40)	*	*		*					*									
Braithwaite (18)	*	*		*			*					*					*	EDI
Bredfeldt (216)	*	*		*			*											
Bresnick (212)	*	*		*			*					*					*	Complete EPR
Bugge et al (38)	*	*		*			*											
Byers (15)	*	*		*			*					*				*	*	Occupational
Cannoy (35)	*	*		*			*			*						*	*	Process
Care Accord (184)	*	*		*			*			*								
Carter (287)	*	*		*			*											
CDC (111)	*	*		*			*			*		*				*		
Centricity (131)	*	*		*			*			*		*				*		

											Sattel “meanin gful use”
Kaelber and Bate (259)					*	*	*	*			
Karl (283)	*	*									* Both organizat ion and process
KC (139)	*					*	*	*		*	
Kern and Kaushal (64)	*	*							*		
Kern et al (125)	*	*									
Key Stone (204)	*	*	*		*	*	*	*			* EHR
Kijisanayotin et al (229)	*	*	*		*	*	*	*			
KLAS (143)	*	*	*		*	*	*	*			* Non- owned hospitals, health systems, ambulatory entities
Kongstvedt (77)	*	*	*		*	*	*	*		*	* entity

